PART 600

WATER AND SEWER

TRENCH EXCAVATION, BACKFILLING AND COMPACTION

601.1 DESCRIPTION:

Municipality	Supplements
PH:	**SECTION 601** **TRENCH EXCAVATING, BACKFILLING AND COMPACTION** Section 601 TRENCH EXCAVATING, BACKFILLING AND COMPACTION is deleted in its entirety and the following section substituted:

The work covered by this specification consists of furnishing all plant, labor, equipment, appliances and materials, and performing all operations in connection with the excavation and backfilling of trenches for a single pipe installation in accordance with the plans and special provisions, except for the installation of high density polyethylene pipe (HDPE). See Section 603 for trench excavation, backfilling, and compaction of HDPE pipe.

Municipality	Supplements
PH:	**601.1 DESCRIPTION:** The work covered by this specification consists of furnishing all plant, labor, equipment, appliances and materials, and performing all operations in connection with the excavation and backfilling of trenches in accordance with the plans and special provisions. Excavation for appurtenant structures, such as manholes, inlets, transition structures, junctions, structures, vaults, valve boxes, catch basins, etc., shall be deemed to be in the category of trench excavation.

Excavation for appurtenance structures, such as manholes, inlets, transition structures, junction structures, vaults, valve boxes, catch basins, etc., shall be deemed to be in the category of trench excavation.

Municipality	Supplements
SC:	**601.1 DESCRIPTION:** *Add the following paragraph:* All trench bedding and backfill shall be in accordance with COS Standard Detail 2201.

601.2 EXCAVATION:

601.2.1 General: The Contractor shall perform all excavation of every description and of whatever substances encountered, to the depths indicated on the plans, and including excavation ordered by the Engineer of compacted backfill for the purpose of making density tests on any portion of the backfill.

All excavation shall be open cut unless otherwise shown on the plans or approved by the Engineer.

Municipality	Supplements
PH:	**601.2 EXCAVATION:** 601.2.1 General: The Contractor shall perform all excavation of every description and of whatever substances encountered, to the depths indicated on the plans, and including excavation ordered by the Engineer of compacted backfill for the purpose of making density tests. All excavation shall be open cut unless otherwise shown on the plans or approved by the Engineer. No extra monetary compensation or additional time will be authorized for claims that soil conditions differ from those anticipated or those indicated by soil logs and/or reports. It is the Contractor's responsibility to make his own determination as to actual existing conditions.

601.2.2 Trench Widths: Trenches for other than cast-in-place concrete pipe shall conform to the dimensions in Table 601-1, unless otherwise specified in the special provisions, indicated on the plans, and/or approved by the Engineer.

TABLE 601-1 TRENCH WIDTHS		
Size Of Pipe (I.D.)	Maximum Width At Top Of Pipe Greater Than O.D. Of Barrel	Minimum Width At Springline Each Side of Pipe (1)
Less than 18 inches	16 inches	6 inches
18 inches to 24 inches inclusive	19 inches	7 1/2 inches
27 inches to 39 inches inclusive	22 inches	9 inches
42 inches to 60 inches inclusive	1/2 O.D.	12 inches
Over 60 inches	36 inches	12 inches

(1) When the specified compaction cannot be obtained in the haunch area and/or bedding zone, the Contractor shall make necessary changes in his methods and/or equipment to obtain the desired results. In some instances, the Minimum Width at Springline shall be adjusted wider to assist the Contractor in obtaining the compaction. The Engineer must be satisfied with the Contractor's compaction effort, concur with the change and approve the revised distance. There shall be no additional cost to the Agency for the extra trench width.

For multiple pipe installations in a single trench, the Engineer shall provide details on the plans or in the Special/Technical Provisions as to the layout, pipe configuration, distances between pipes and trench walls, the type of backfill, bedding and foundation materials, etc.

The width of the trench shall not be greater than the maximum indicated in Table 601-1, at and below the level of the top of the pipe. The width of the trench above that level may be made as wide as necessary for sheeting and bracing, and for proper installation of the work.

If the maximum trench width as specified in Table 601-1 is exceeded at the top of the pipe the Contractor shall provide, at no additional cost to the Contracting Agency, the necessary additional load bearing capacity by means of bedding, having a higher bedding factor than that specified, higher strength pipe, a concrete cradle, cap or encasement, or by other means approved in writing by the Engineer.

Municipality	**Supplements**
PH:	**601.2.2 Trench Widths:** Trenches for other than cast-in-place concrete pipe shall conform to the following dimensions, unless otherwise specified in the special provisions, indicated on the plans, and/or approved by the Engineer. Table 601-1 The width of the trench shall not be greater than the maximum indicated above, at and below the level of the top of the pipe. If the maximum trench width as specified above is exceeded at the top of the pipe, the Contractor shall provide, at no additional cost to the Contracting Agency, the necessary additional load bearing capacity by means of bedding, having a higher bedding factor than that specified, higher strength pipe, a concrete cradle, cap or encasement, or by other means approved in writing by the Engineer. The width of the trench above the top of the pipe may be made as wide as necessary for shoring, sheeting or other wall support measures necessary for a safe and proper installation. The Contractor may elect to slope the trench walls in leiu of shoring, sheeting or other wall support measures. In all cases the Contractor shall be responsible for any and all problems encountered and costs incurred as a result of increased trench width. No increases in contract time will be allowed as a result of sloping trench walls. The MAG Trench Pay Width (Section 336) will be used for computing payment.

601.2.3 Trench Grade: Alignment and elevation stakes shall be furnished the Contractor at set intervals and agreed upon offsets. On water main projects, elevation stakes will be furnished only when deemed necessary by the Engineer. In all cases where elevation stakes are furnished, the Engineer will also furnish the Contractor with cut sheets.

For all pipe 12 inches or greater in diameter, the Contractor shall excavate for and provide an initial granular bedding at least 4 inches thick or 1/12 the O.D. of the pipe whichever is greater. This bedding material shall be placed at a uniform density with minimum compaction and fine graded as specified below.

Bell or coupling holes shall be dug after the trench bottom has been graded. Such holes shall be of sufficient width to provide ample room for caulking, banding, or bolting. Holes shall be excavated only as necessary to permit accurate work in the making of the joints and to insure that the pipe will rest upon the prepared bottom of the trench, and not be supported by any portion of the joint.

Depressions for joints, other than bell-and-spigot, shall be made in accordance with the recommendations of the joint manufacturer for the particular joint used.

Municipality	Supplements
PH:	**601.2.3 Trench Grade:** Alignment and elevation stakes shall be furnished by the Contractor at set intervals and agreed upon offsets. On water main projects, elevation stakes will be furnished only when deemed necessary by the Engineer. In all cases where elevation stakes are furnished, the Engineer will also furnish the Contractor with cut sheets. For all pipe 8 inches or greater in diameter, the Contractor shall excavate for and provide an initial granular bedding at least four inches thick or 1/12 the O.D. of the pipe whichever is greater. This bedding material shall be placed at a uniform density with minimum compaction and fine graded as specified below. Bell or coupling holes shall be dug after the trench bottom has been graded. Such holes shall be of sufficient width to provide ample room for caulking, banding or bolting. Holes shall be excavated only as necessary to permit accurate work in the making of the joints and to ensure that the pipe will rest upon the prepared bottom of the trench, and not be supported by any portion of the joint. Depression for joints, other than bell-and-spigot, shall be made in accordance with the recommendations of the joint manufacturer for the particular joint used.

Municipality	Supplements
SC:	**601.2.3 Trench Grade:** *Modify the second sentence of the first paragraph to read as follows (Modified text is highlighted):* On water main projects, elevation stakes will be furnished **for waterlines 12 inches or more in diameter.** *Modify the first sentence of the second paragraph to read as follows (Modified text is highlighted):* For all **sewer** pipe **8** inches or greater in diameter **and water pipe 12 inches or greater in diameter,** the Contractor shall excavate for and provide an initial granular bedding at least four inches thick or 1/12 the O.D. of the pipe whichever is greater.

601.2.4 Fine Grading: Unless otherwise specified in the plans and/or special provisions, the bottom of the trench shall be accurately graded to provide uniform bearing and support for each section of the pipe at every point along its entire length, except for portions of the pipe where it is necessary to excavate for bells and for proper sealing of the pipe joints.

Municipality	Supplements
PH:	**601.2.4 Fine Grading:** Unless specified in the plans and/or special provisions, the bottom of the trench shall be accurately graded to provide uniform bearing and support for each section of the pipe at every point along its entire length, except for portions of the pipe where it is necessary to excavate for bells and for proper sealing of pipe joints.

601.2.5 Overexcavation: Except at locations where excavation of rock from the bottom of the trench is required, care shall be taken not to excavate below the depth indicated.

Unauthorized excavation below the specified grade line shall be refilled at the Contractor's expense with ABC material compacted to a uniform density of not less than 95 percent of the maximum density as determined by AASHTO T-99 and T-191 or ASTM D-2922 and D-3017. When AASHTO T-99, method A or B, and T-191 are used for density determination, MAG Detail 190 will be used for rock correction.

Whenever rock is encountered in the trench bottom, it shall be overexcavated to a minimum depth of six inches below the O.D. of the pipe. This overexcavation shall be filled with granular material placed with the minimum possible compaction.

Whenever unsuitable soil incapable of supporting the pipe is encountered, the Contractor will notify the Engineer and a field determination will be made as to the depth of overexcavation and the granular fill required.

Municipality	Supplements
PH:	**601.2.5 Overexcavation:** Except at locations where excavation of rock from the bottom of the trench is required, care shall be taken not to excavate below the depth indicated. Unauthorized excavation below the specified grade line shall be refilled at the Contractor's expense with ABC material compacted to a uniform density of not less than 95 percent of the maximum density as determined by AASHTO T-99 and T-191 or ASTM D-2922 and D- 3017. When AASHTO T-99, method A or B, and T-191 are used for density determination, MAG Detail 190 will be used for rock correction. Whenever rock is encountered in the trench bottom, it shall be overexcavated to a minimum depth of six inches below the O.D. of the pipe. This overexcavation shall be filled with granular material placed with the minimum possible compaction. Whenever unsuitable soil, not capable of supporting the pipe is encountered, the Contractor will notify the Engineer and a field investigation will be made. If the Engineer determines that overexcavation and backfilling, below the normal foundation and bedding depth, are required as a result of unsuitable material, it will be considered extra work. Payment and construction time extension will be negotiated with the Contractor. As a condition of the Contractor receiving payment for the extra work, agreement on method of payment and construction time extensions shall be reached prior to start of work.

Municipality	Supplements
SC:	**601.2.5 Overexcavation:** *Add the following paragraph:* For PVC and HDPE sewer pipe trenches over-excavated in excess of 0.30 feet, Class I, II, or III material shall be provided as a foundation (see ASTM D-2321). This foundation material shall be compacted within a range of +2 percent to -4 percent of optimum moisture content to a minimum 90 percent density

601.2.6 Excavation for Manholes, Valves, Inlets, Catch Basins and Other Accessories: The Contractor may excavate to place the concrete structure directly against the excavated surface, provided that the faces of the excavation are firm and unyielding and are at all points outside the structure lines shown on the plans. If the native material is such that it will not stand without sloughing or if precast structures are used, the Contractor shall overexcavate to place the structure and this overexcavation shall be backfilled with the same material required for the adjoining pipe line trench and compacted per Table 601-2.

Any unnecessary excavation below the elevation indicated for the foundation of any structure shall be replaced with the same class of concrete specified for the structure or with 1 1/2 sack controlled low strength material as specified in Section 728. When the replacement material is structural concrete, the material shall be placed at the same time as the structure. However, when using 1 1/2 sack controlled low strength material, placement of the material shall be per Section 604 which will require a time lag between the material and the structural concrete. The placement of the additional material shall be at no cost to the Agency.

Municipality	Supplements
PH:	**601.2.6 Excavation for Manholes, Valves Inlets, Catch Basins and Other Accessories:** When placing concrete for a poured-in-place structure, the Contractor may place the poured concrete directly against the excavated surface, provided that the faces of the excavation are firm and unyielding and are at all points outside the structure lines shown on the plans. If the native material is such that it will not stand without sloughing or if precast structures are used, the Contractor shall overexcavate to place the structure. When the structure is within the open trench limit, backfilling shall be in accordance with the requirements specified for the adjoining pipe. If the item is being constructed outside of the open trench limits, the overexcavation shall be backfilled with ABC compacted to 100%. Any excavation below the elevation indicated for the foundation of any structure shall be filled with ABC per MAG 702 and compacted to at least 95% at the expense of the Contractor.

601.2.7 Pavement and Concrete Cutting and Removal: Where trenches lie within the portland cement concrete section of streets, alleys, driveways, or sidewalks, etc., such concrete shall be sawcut to neat, vertical, true lines in such a manner that the adjoining surface will not be damaged. The minimum depth of cut shall be 1 1/2 inches or 1/4 of the thickness, whichever is greater.

Asphalt pavement shall be clean-cut, with approved equipment and by approved methods in accordance with the requirements of Section 336.

No ripping or rooting will be permitted outside limits of cuts. Surfacing materials removed shall be hauled from the job site immediately, and will not be permitted in the backfill.

Municipality	Supplements
PH:	**601.2.7 Pavement and Concrete Cutting and Removal:** Where trenches lie within the portland cement concrete section of streets, alleys, driveways or sidewalks, etc., such concrete shall be sawcut to neat, vertical, true lines in such a manner that the adjoining surface will not be damaged. The minimum depth of cut shall be 1-1/2 inches or 1/4 of the thickness, whichever is greater. Asphalt pavement shall be clean-cut, with approved equipment and by approved methods in accordance with the requirements of Section 336. No ripping or rooting will be permitted outside limits of cuts. Surfacing materials removed shall be hauled from the job site immediately, and will not be permitted in the backfill.

601.2.8 Grading and Stockpiling: All grading in the vicinity of trench excavation shall be controlled to prevent surface water from flowing into the trenches. Any water accumulated in the trenches shall be removed by pumping or by other approved methods.

During excavation, material suitable for backfilling shall be piled in an orderly manner, a sufficient distance back from the edges of trenches, to avoid overloading and to prevent slides or cave-ins. Material unsuitable for backfilling, or excess material, shall be hauled from the job site and disposed of by the Contractor.

The Contractor shall, prior to final acceptance of the work, submit a letter to the Contracting Agency stating the location of each disposal site for all excess or unsuitable material and certify that he has obtained the property owner's permission for the disposal of all such materials.

Where the plans and/or special provisions provide for segregation of topsoil from underlying material for purposes of backfill, the material shall not be mixed.

Municipality	Supplements
PH:	**601.2.8 Grading and Stockpiling:** All grading in the vicinity of trench excavation shall be controlled to prevent surface water from flowing into the trenches. Any water, either surface or ground, accumulated in the trench(es) shall be removed by pumping or by other approved methods. There shall be no additional payment for this work. During excavation, material suitable for backfilling shall be piled in an orderly manner, a sufficient distance back from the edges of trenches, to avoid overloading and to prevent slides or cave-ins. Excess material shall be hauled from the job site and disposed of by the Contractor. Excavated material, with excessive or inadequate moisture content, shall be considered unsuitable for proper compaction. The Contractor shall, at his own expense, remove or add moisture to the excavated material to bring it within the range of +2 to -4 percent of the optimum moisture content in order that proper compaction, as per Table 601.2, can be obtained. In lieu of the above, the Contractor may, at no cost to the Contracting Agency, haul-off and dispose of excessively wet or dry material and replace it with material conforming to the backfill specifications. Disposal shall be in accordance with the project specifications. In either event, the proper compaction and stability shall be obtained. There will be no additional payment or time extension for this work. Where the plans and/or special provisions provide for segregation of topsoil from underlying material for purposes of backfill, the material shall not be mixed.

601.2.9 Shoring and Sheeting: The Contractor shall do such trench bracing, sheathing, or shoring necessary to perform and protect the excavation as required for safety and conformance to governing laws. The bracing, sheathing, or shoring shall not be removed in one operation but shall be done in successive stages as determined by the Engineer to prevent overloading of the pipe during backfilling operations. The cost of the bracing, sheathing, or shoring, and the removal of same, shall be included in the unit price bid for the pipe.

All shoring and sheeting deemed necessary to protect the excavation and to safeguard employees, shall be installed. See Section 107.

Municipality	Supplements
CH:	**SPECIFICATION NO. 4:** UTILITY TRENCHING - BRACING, SHORING, AND SHEETING When vertical side walls are to be excavated and trench boxes are not used, the contractor shall do such trench bracing, sheathing, or shoring necessary to perform and protect the excavation as required for safety and conformance to governing laws. Shoring, sheeting, or other protective procedures reviewed by the Engineer or his designee for conformance to standards shall be required when the trench depth exceeds five feet. The contractor shall provide a shoring and bracing plan designed by his engineer for review for adherence to OSHA requirements. Spacing of shoring braces shall not exceed ten feet center to center. The bracing, sheathing, or shoring shall not be removed in one operation, but shall be done in successive stages as determined by the Engineer to prevent overloading the pipe during backfilling operations. On City of Chandler projects only, the cost to brace, sheath, or shore, and removal of same, shall be included in the unit bid price per foot of the pipe.

PH:	**601.2.9 Shoring and Sheeting:** The Contractor shall do such trench bracing, sheathing or shoring necessary to perform and protect the excavation as required for safety and conformance to governing laws. The bracing, sheathing or shoring shall not be removed in one operation but shall be done in successive stages as determined by the Engineer to prevent overloading of the pipe during back-filling operations. The cost of the bracing, sheathing or shoring, and the removal of same, shall be included in the unit price bid per foot for the pipe. All shoring and sheathing deemed necessary to protect the excavation and to safeguard the Engineer's representatives during inspection and testing procedures shall be installed. See Section 107.

601.2.10 Open Trench: Except where otherwise noted in the special provisions, or approved in writing by the Engineer, the maximum length of open trench, where the construction is in any stage of completion (excavation, pipe laying or backfilling), shall not exceed 1320 feet in the aggregate at any one location.

Any excavated area shall be considered open trench until all ABC for pavement replacement has been placed and compacted. With the approval of the Engineer, pipe laying may be carried on at more than one separate location, the restrictions on open trench applying to each location. Trenches across streets shall be completely backfilled as soon as possible after pipe laying.

Substantial steel plates with adequate trench bracing shall be used to bridge across trenches at street crossings where trench backfill and temporary patches have not been completed during regular work hours. Safe and convenient passage for pedestrians shall be provided. The Engineer may designate a passage to be provided at any point he deems necessary. Access to hospitals, fire stations and fire hydrants must be maintained at all times.

Municipality	**Supplements**
PH:	**601.2.10 Open Trench:** Except where otherwise noted in the special provisions, or approved in writing by the Engineer, the maximum length of open trench, where the construction is in any stage of completion (excavation, pipe laying or backfilling), shall not exceed 1,320 feet in the aggregate at any one location. Any excavated area shall be considered open trench until all ABC for pavement replacement has been placed and compacted. With the approval of the Engineer, pipe laying may be carried on at more than one separate location, the restrictions on open trench applying to each location. Where a trenching operation undercrosses ACP waterlines(12 inches or smaller excluding service lines) and four feet or more of the existing pipe is exposed, the Water Distribution Division will isolate the conflicting waterline by either cutting in any necessary valves or by the use of existing valves. After the crossing section has been isolated, the Contractor shall remove that part of the waterline and install the new mainline as per plan. The waterline shall then be replaced with the same size ductile iron pipe by the Contractor. The replacement section shall extend at least five feet beyond the new mainline trench wall and into undisturbed ground. The Contractor shall request a shut-down, at least one week in advance, from Water Distribution (262-4711 or 4712). City forces will perform the shutdown and/or valve cut-in. There will be no charges to the Contractor for this work. On permit work, the Contractor shall pay for any and all work required. The Contractor will be paid for the ductile iron pipe at the unit price bid per each crossing under the bid schedule item WATERLINE REPLACEMENT. If there is an unanticipated conflict at the crossing which can be resolved with "offset pipe joints", the Water Department will supply the offset joints to the Contractor at no cost. Offset pipe joints will be picked up by the Contractor at the City's Water Stores Warehouse at 2640 South 22nd Avenue. Requests to pick up such material must be conveyed to the Water Department at least 24 hours in advance by the City Inspector. The Contractor shall install the offset joints at no additional cost. The WATERLINE REPLACEMENT item shall include costs for trench excavation, backfill, compaction, and surface restoration. Trenches across streets shall be completely backfilled as soon as possible after pipe laying. Substantial steel plates with adequate trench bracing shall be used to bridge across trenches at street crossings where trench backfill and temporary patches have not been completed during regular working hours. Traffic control and maintenance of traffic shall be in accordance with City of Phoenix Section 401 and MAG Section 104.

601.3 PROTECTION OF EXISTING UTILITIES:

601.3.1 Utilities: Unless otherwise shown on the plans or stated in the specifications, all utilities, both underground or overhead, shall be maintained in continuous service throughout the entire contract period. The Contractor shall be responsible and liable for any damages to or interruption of service caused by the construction.

If the Contractor desires to simplify his operation by temporarily or permanently relocating or shutting down any utility or appurtenance, he shall make the necessary arrangements and agreements with the owner and shall be completely responsible for all costs concerned with the relocation or shutdown and reconstruction. All property shall be reconstructed in its original or new location as soon as possible and to a condition at least as good as its previous condition. This cycle of relocation or shutdown and reconstruction shall be subject to inspection and approval by both the Engineer and the owner of the utility.

The Contractor shall be entirely responsible for safeguarding and maintaining all conflicting utilities that are shown on the plans (Sections 107 and 105 apply). This includes overhead wires and cables and their supporting poles whether they are inside or outside of the open trench. If, in the course of work, a conflicting utility line that was not shown on the plans is discovered, the Contracting Agency will either negotiate with the owner for relocation, relocate the utility, change the alignment and grade of the trench or as a last resort, declare the conflict as “extra work” to be accomplished by the Contractor in accordance with Section 104.

Municipality	Supplements
PH:	**601.3 PROTECTION OF EXISTING UTILITIES:** 601.3.1 Utilities: Unless otherwise shown on the plans or stated in the specification, all utilities, both underground and overhead, shall be maintained in continuous service throughout the entire contract period. The Contractor shall be responsible and liable for any damages to or interruption of service caused by the construction. If the Contractor desires to simplify his operation by temporarily or permanently relocation or shutting down any utility or appurtenance, he shall make the necessary arrangements and agreements with the owner and shall be completely responsible for all costs concerned with the relocation or shutdown and reconstruction. All property shall be reconstructed in its original or new location as soon as possible and to a condition at least as good as it’s previous condition. This cycle of relocation or shutdown and reconstruction shall be subject to inspection and approval by both the Engineer and the owner of the utility. The Contractor shall be entirely responsible for safeguarding and maintaining all conflicting utilities that are shown on the plans (MAG Section 106 & 107 apply). This includes overhead wires and cables and their supporting poles whether they are inside or outside the open trench. If, in the course of work, a conflicting utility line that was not shown on the plans is discovered, the Contracting Agency will either negotiate with the owner for relocation, relocate the utility, change the alignment and grade of the trench or, as a last resort, declare the conflict as "extra work" to be accomplished by the Contractor in accordance with Section 104.

601.3.2 Irrigation Ditches, Pipes and Structures: The Contractor shall contact the owners of all irrigation facilities, and make arrangements for necessary construction clearances and/or dry-up periods.

All irrigation ditches, dikes, headgates, pipe, valves, checks, etc., damaged or removed by the Contractor, shall be restored to their original condition or better, by the Contractor at no additional cost to the Contracting Agency.

Municipality	Supplements
PH:	**601.3.2 Irrigation Ditches, Pipes and Structures:** The Contractor shall contact the owners of all irrigation facilities, and make arrangements for necessary construction clearances and/or dry-up periods. All irrigation ditches, dikes, headgates, pipe valves, checks, etc., damaged or removed by the Contractor, shall be restored to their original condition or better, by the Contractor at no additional cost to the Contracting Agency.

601.3.3 Building, Foundations and Structures: Where trenches are located adjacent to building, foundations, and structures, the Contractor shall take all necessary precaution against damage to them. The Contractor shall be liable for any damage caused by the construction.

Except where authorized in the special provisions or in writing by the Engineer, water settling of backfill material in trenches adjacent to structures will not be permitted.

Municipality	Supplements
PH:	**601.3.3 Buildings, Foundations and Structures:** Where trenches are located adjacent to buildings, foundations, bridges or any other structures, the Contractor shall take all necessary precaution against damage to them. The Contractor shall be liable for any damage caused by the construction. Except where authorized in the special provisions or in writing by the Engineer, water settling of backfill material in trenches adjacent to structures will not be permitted.

601.3.4 Permanent Pipe Supports: Permanent pipe supports for the various types and sizes of sewer, water and utility lines shall conform to the Standard Details or the details shown on the plans. Such pipe supports shall be erected at the locations shown on the plans and/or at any other locations as necessary as determined by the Engineer.

Municipality	Supplements
PH:	**601.3.4 Permanent Pipe Supports:** Permanent pipe supports for the various types and sizes of sewer, water and utility lines shall conform to the Standard Details or the details shown on the plans. Such pipe supports shall be erected at the locations shown on the plans and/or at any other locations as necessary, or as determined by the Engineer.

601.3.5 Electronic, Telephonic, Telegraphic, Electrical, Oil and Gas Lines: These underground facilities shall be adequately supported by the Contractor. Support for plastic pipes shall be continuous along the bottom of the pipe. Support for metal pipe and electrical conduit may be continuous or nylon webbing may be used for suspension at no greater than ten-foot intervals.

The Contractor shall avoid damaging the plastic pipe, pipeways or conduits during trench backfilling and during foundation and bedding placement.

There will be no measurement or payment for this work. The Contractor will include all associated costs in the unit bid price for the conduit installation.

Municipality	Supplements
PH:	**601.3.5 Electronic, Telephonic, Telegraphic, Electrical, Oil and Gas Lines:** These underground facilities shall be adequately supported by the Contractor. Support for plastic pipes shall be continuous along the bottom of the pipe. Support for metal pipe and electrical conduit may be continuous or nylon webbing may be used for suspension at no greater than ten-foot intervals. The Contractor shall avoid damaging the plastic pipe, pipeways or conduits during a trench backfilling and during foundation and bedding placement. There will be no measurement or payment for this work. The Contractor will include all associated costs in the unit bid price for the pipe installation.

Municipality	Supplements
SC: added the following	**601.3.6 Utility/Water Line Crossings: Locator Strips and ABC Slurry** Primary electrical conductors, natural gas, or fiber optic telephone lines shall not be allowed to cross above water lines unless approved in writing by the COS Water Resources Department. If a primary electrical conductor, natural gas, or fiber optic telephone line is allowed to cross above a water line, then ABC slurry and double utility locator strips shall be provided. The required utility locator strips shall be a minimum three (3) inch wide, color coded for the appropriate utility, and shall be laid in a criss-crossing pattern along both the water line and the over-crossing utility alignments. The horizontal placement of the utility locator strips shall be along the centerline of the alignments. The vertical placement of the utility locator strips shall be at an elevation one (1) foot above the over-crossing electrical/natural gas/fiber optic line. The utility locator strips shall extend six (6) feet on both sides of the point of intersection for both the water line and the over-crossing utility line. The requirement of placing criss-crossing locator strips may be waived by the COS Water Resources Department if locator strip placement requires trenching in pre-existing pavement. The required ABC slurry mix shall be placed in the over-crossing utility trench from the top of the shading/ embedment zone (maximum of 12 inches above the uppermost conduit) and shall have a minimum thickness of one (1) foot. The ABC slurry shall extend six (6) feet on both sides of the point of intersection with the water line. This requirement may be waived by the COS Water Resources Department if the over-crossing line is being placed by means of boring. The ABC slurry mix shall meet the requirements contained in COS Supplemental Specification Section 728.

Municipality	Supplements
SC: added the following	**601.3.7 Water Lines: Marking Tape** Pipe marking tape shall be installed over all water lines. Pipe marking tape shall be a minimum 4.0 mils thick, inert polyethylene plastic that is impervious to all known alkalis, acids, chemical reagents and solvents likely to be encountered in the soil. For pipe diameter 24 inches or less, the tape width shall be 6 inches or greater. For pipe diameter larger than 24 inches, the tape width shall be 12 inches or greater. Marking tape shall be blue in color with the following message printed thereon: "POTABLE WATER LINE". The tape message shall be imprinted continuously over the entire length in permanent black lettering with the message spacing not to exceed 18 inches. The lettering shall be a minimum 1 1/2 inches high. The spacing between the individual words of the message shall not exceed three inches. Marking tape shall be buried 24 inches below the surface over the center of the pipe. The backfill shall be sufficiently leveled so that the tape is installed on a flat surface. The tape shall be centered in the trench with the printed side up.

601.4 FOUNDATION, BEDDING, BACKFILLING AND COMPACTION:

601.4.1 Foundation: The material upon which the conduit or structure is to be placed shall be accurately finished to the grade or dimensions shown on the plans or as directed by the Engineer. The bottom portion of the trench shall be brought to grade so that the conduit or structure will be continuously in contact with the material on which it is being placed. If rocky or unsuitable soil is encountered, Subsection 601.2.5 applies.

Municipality	Supplements
PH:	**601.4 FOUNDATION, BEDDING, BACKFILLING AND COMPACTION:** 601.4.1 Foundation: The material upon which the conduit or structure is to be placed shall be accurately finished to the grade or dimensions shown on the plans or as directed by the Engineer. The bottom portion of the trench shall be brought to grade so that the conduit or structure will be continuously in contact with the material on which it is being placed. If rocky or unsuitable soil is encountered, Subsection 601.2.5 applies.

601.4.2 Bedding: Bedding shall consist of granular material containing no pieces larger than 1 1/2 inches and free of broken concrete, broken pavement, wood or other deleterious material. Open graded rock will not be used without the written approval of the Engineer.

Where water consolidation is used, bedding for conduits, 24 inches or less in I.D., may be placed in one lift. For larger conduits the first lift shall not exceed the springline of the pipe.

Where mechanical compaction is used, the moisture content shall be such that the specified compaction can be obtained. The first lift shall be 8 inches or two-thirds of the distance to the springline whichever is greater. Succeeding lifts shall not exceed 2 feet loose and extreme care will be taken to prevent damage to or movement of the conduit by the compaction equipment.

Municipality	Supplements
PH:	**601.4.2 Bedding:** Bedding is the material placed in the area from the bottom of the trench to one foot above the top of the pipe or conduit. Bedding shall be Select Material Type B or Aggregate Base as per Table 702. Open graded rock will not be used without the written approval of the Engineer. Where water consolidation is used, bedding for conduits, 24 inches or less in I.D., may be placed in one lift. For larger conduits, the first lift shall not exceed the springline of the pipe. Where mechanical compaction is used, the moisture content shall be within a range of +2 to -4 percent of the optimum moisture content prior to placing the material in the trench. The first lift shall be eight inches or 2/3 of the distance to the springline whichever is greater. Succeeding lifts shall not exceed one foot loose and extreme care will be taken to prevent damage to or movement of the conduit by the compaction equipment.

Municipality	Supplements
SC:	**601.4.2 Bedding:** *Modify the first sentence of the first paragraph to read as follows (Modified text is highlighted):* Bedding shall be **Select Material Type B or Aggregate Base as per MAG Table 702,** or granular material containing no pieces larger than 1-1/2 inches and free of broken concrete, broken or recycled pavement, wood or other deleterious material. *Modify the first two sentences of the third paragraph to read as follows (Modified text is highlighted):* Where mechanical compaction is used, the moisture content shall be **within a range of +2 percent to -4 percent of the optimum moisture content prior to placing the material in the trench.** The first lift shall be 8 inches or **2/3 (two-thirds)** of the distance to the springline whichever is greater.

601.4.3 Backfill: Backfill shall be sound earthen material free from broken concrete, broken pavement, wood or other deleterious material. Unless otherwise specified, this may be native material with no piece larger than 4 inches, select material or aggregate base course. Backfill under street pavement shall be constructed per Detail 200 with the type of replacement noted on the plans or in the special provisions. Unless otherwise noted, backfill under single curb, curb and gutter, sidewalk, driveways, valley gutters, etc. shall be the same as the adjacent street pavement.

Where water consolidation is used, backfill will be placed in lifts as required in the following table prior to settlement.

Trench Width	Backfill Lifts
18″ to 24″	Not to exceed 4′
25″ to 36″	Not to exceed 6′
Over 36″	Not to exceed 8′

The above backfill lift limitations are not applicable when water saturation is done by the jetting method.

Where mechanical compaction is used, backfill shall be placed in lifts the height of which shall not exceed that which can be effectively compacted depending on the type of material, type of equipment and methods used, and under no circumstances shall exceed 4 feet.

Backfill, around utilities that are exposed during trench excavation, shall be placed in accordance with the bedding methods.

Municipality	**Supplements**
MC:	Section 601.4.3 add the following: Backfill material for pipes, pipe-arches, or arches made of metal shall have a value of resistivity not less than 2000 ohm-cm or of the value shown on the project Plans. When resistivity is not shown on the Plans, the backfill material shall have a value of resistivity not less than that of the existing in-place material or 2000 ohm-cm, whichever is less. Backfill material for all metal pipe installations shall have a pH value between 6.0 and 9.0 inclusive. Backfill material for all concrete or plastic pipe installations shall have a pH value between 6.0 and 12.0. Tests for pH and resistivity shall be in accordance with the requirements of Arizona Test Method 236. Trenches within existing paved areas shall use ½ sack CLSM for backfill unless use of an alternative material has received prior approval.
PH:	**601.4.3 Backfill:** The type of backfill required shall conform to the specifications in City of Phoenix Supplements, Section 336.3 TYPES AND LOCATION OF PAVEMENT AND SURFACING REPLACEMENT**.** Backfill shall be sound material free from broken concrete, broken pavement, wood or other deleterious material. Unless otherwise specified, this may be native material with no piece larger than eight inches, select material or aggregate base course. Under pavement, parking lots, sidewalks, etc., pieces larger than three inches will not be used in the final 12 inches below the pavement subgrade. Where water consolidation is used, backfill will be placed in lifts as required in the following table prior to settlement.

Municipality	Supplements
PH:	TRENCH WIDTH BACKFILL LIFTS 18" TO 24" NOT TO EXCEED 4' 25" TO 36" NOT TO EXCEED 6', OVER 36" NOT TO EXCEED 8' The above backfill lift limitations are not applicable when water consolidation is accomplished by the jetting method. When mechanical compaction is to be used, the Contractor will provide a test section demonstrating his proposed method and equipment to be used. Upon agreement with the Engineer as to the acceptability of the Contractor's proposed method and equipment, they shall not be changed without the prior approval of the Engineer. Mechanical compacted lifts in excess of one foot will not be allowed without the written consent of the Engineer. Backfill material shall be within the range of +2% to -4% of the optimum moisture content, prior to placing the material in the trench. The moisture content shall be uniform throughout the backfill material. Material not meeting these requirements may be required to be removed from the trench and moisture added or removed to correct the deficiencies prior to replacement, all at no increase in cost to the Contracting Agency. It shall be the Contractor's responsibility to blend excavated material, removing or adding moisture as may be necessary to meet the requirements of the specifications, all at no increase in cost to the Contracting Agency. Excavated material, when used for backfill, shall meet the requirements of Subsection 601.2.8. The moisture content requirements contained herein are waived when granular material is used and water settled. The Engineer may require all or any part of the trench to be load tested for stability with Contractor's equipment prior to placement of asphalt or Portland cement concrete pavement. Unstable areas as determined by the Engineer shall be corrected by the Contractor at no increase in cost to the Contracting Agency. Backfill, around utilities that are exposed during trench excavation, shall be placed in accordance with the bedding methods.

601.4.4 Compaction Densities: Unless otherwise provided in the plans and/or special provisions, the trench backfill shall be thoroughly compacted to not less than the densities in Table 601-2 when tested and determined by AASHTO T-99 and T-191 or ASTM D-2922 and D-3017. When AASHTO T-99, method A or B, and T-191 are used for density determination, MAG Detail 190 will be used for rock correction.

The density required will depend on the Type shown on the plans and/or called for in the special provisions. Density required for each type shall comply to Table 601-2.

TABLE 601-2				
MINIMUM TRENCH COMPACTION DENSITIES				
Backfill Type	**Location**	**From Surface To 2 feet Below Surface**	**From 2 feet Below Surface To 1 foot Above Top of Pipe**	**From 1 foot Above Top of Pipe to Bottom of Trench**
I	Under any existing or proposed pavement, curb, gutter, sidewalk, or such construction included in the contract, or when any part of the trench excavation is within 2′ of the above.	100% for granular 95% for non-granular	90%	90%
II	On any utility easement street, road or alley right-of-way outside limits of (I).	85%	85%	90%
III	Around any structures or exposed utilities.	95% in all cases		

Note: The type required will generally be shown on the plans and the plans will govern. Where no type is shown on the plans the type shall comply with Table 601-2.

A consideration in determining the backfill Types as shown on the plans, is based on the trench widths as shown in the Contract Documents. If these trench widths increase beyond those widths referred to above and fall within the 2-foot limit of paved surfaces and other improvements due to construction exigencies, the backfill designation for that portion within the 2-foot limit of such improvements shall be Type I even though Type II backfill is shown on the plans.

Municipality	**Supplements**
GL:	**601.4.4 Compaction Densities:** Added by Glendale 5. MAG 601.4.4 Compaction Densities: Unless otherwise noted, the backfill compaction densities listed below, shall be determined using the Modified Proctor Method, ASTM D-1557.

Municipality	**Supplements**
PH:	**601.4.4 Compaction Densities:** Unless otherwise provided in the plans and/or special provisions, the trench backfill shall be thoroughly compacted to not less than the following densities when tested and determined by AASHTO T-99 and T-191 or ASTM 0-2922 and 0-3017. When AASHTO T-99, method A or B, and T-191 are used for density determination, MAG Detail 190 will be used for rock correction. The density required will depend on the type shown on the plans and/or called for in the special provisions. Density required for each type is as follows:

Municipality	Supplements
PH:	TABLE 601-2 MINIMUM DENSITY REQUIRED FOR TRENCH BACKFILL

Compaction Type	Location	From Surface to 2' Below Surface	From 2' Below Surface to 1' Above Top of Pipe	From 1' Above Top of Pipe to Bottom of Trench
I	Under any existing or proposed pavement, curb, gutter, sidewalk, or such construction included in the contract, or when any part of the trench excavation is within 2' of the above.	100% granular 100% for non-granular (2)	95%	95%
II	On any utility easement, street, road or alley right-of-way outside limits of (1)	85%	85%	95%
III	Around any structure or exposed utilities.	95%	in all cases	in all cases

Municipality	Supplements
PH:	(1) Note: The type required will generally be shown on the plans and the plans will govern. Where no type is shown on the plans the type shall comply with the above. A consideration in determining the backfill types as shown on the plans, is based on the trench widths as shown in the Contract Documents. If these trench widths are increased beyond those widths referred to above and fall within the 2-foot limit of paved surfaces and other improvements due to construction exigencies, the backfill designation for that portion within the 2-foot limit of such improvements shall be Type I even though Type II backfill is shown on the plans.

Municipality	Supplements
SC:	**601.4.4 Compaction Densities:** *Add the following paragraph:* For sewer lines, compaction tests in both the bedding zone and the backfill zone shall be conducted at intervals specified by the COS Field Engineering Manager or designated representative.

601.4.5 Compaction Methods: Water consolidation by jetting shall be accomplished with a 1 1/2 inches pipe of sufficient length to reach the bottom of the lift being settled with adequate hose attached and a water pressure of not less than 30 psi. All jetting shall be accomplished traversely across the trench at intervals of not more than 6 feet with the jetting locations on one side of the trench offset to the jetting locations on the other side of the trench. The entire lift shall be leveled and completely saturated working from the top to the bottom.

Jetting shall be used as the consolidation method for all conduit bedding. The Contractor shall be entirely responsible for establishing each lift depth so as to avoid floating the conduit being placed and shall make any repair or replacement at no cost to the Contracting Agency. However, for conduit larger than 24 inches I.D. the first lift shall not exceed the springline of the conduit.

Flooding is not acceptable as a water consolidation method unless authorized in the specification or by a written change order. It will consist of the inundation of the entire lift with water and then puddled with poles or bars to insure saturation of the entire lift.

Where jetting or flooding is utilized and the surrounding material is such that it does not permit proper drainage, the Contractor shall provide, at his expense a sump and a pump at the downstream end to remove the accumulated water.

The use of water consolidation does not relieve the Contractor from the responsibility to make his own determination that such methods will not result in damage to existing improvements. The Contractor shall be responsible for any damage incurred.

Where water consolidation is not permitted or does not result in adequate compaction, the backfill material shall be compacted with hand and/or mechanical work methods using equipment such as rollers, pneumatic tamps, and hydro-hammers or other approved devices which secure uniform and required density without injury to the pipe or related structures.

Where Type I backfill is required, water consolidation will not be permitted for non-granular material, except in the following situation. In a new development prior to paving and prior to opening the area to public traffic, water consolidation, will be permitted for non-granular material at the Contractor's discretion and responsibility.

Municipality	**Supplements**
MC:	Section 601.4.5 – Revise the first sentence of the third paragraph of this subsection to read as follows: Flooding is acceptable as a water consolidation method unless it is disallowed in the Plans or Special Provisions. Delete the last paragraph of this Subsection.
Municipality	**Supplements**
PH:	**601.4.5 Compaction Methods:** Water consolidation by jetting shall be accomplished with a 1-1/2" pipe of sufficient length to reach the bottom of the lift being settled with adequate hose attached and a water pressure of not less than 30 psi. All jetting shall be accomplished transversely across the trench at intervals of not more than 6 feet with the jetting locations on one side of the trench offset to the jetting locations on the other side of the trench. The entire lift shall be leveled and completely saturated working from top to the bottom. Jetting shall be used as the consolidation method for all conduit bedding. The Contractor shall be entirely responsible for establishing each lift depth so as to avoid floating the conduit being placed and shall make any repair or replacement at no cost to the Contracting Agency. However, for conduit larger than 24 inches I.D. the first lift shall not exceed the springline of the conduit. Flooding is not acceptable as a water consolidation method unless authorized in the specification or by a written change order. It will consist of the inundation of the entire lift with water and then puddled with poles and bars to ensure saturation of the entire lift. Where jetting or flooding is utilized and the surrounding material is such that is does not permit proper

	drainage, the Contractor shall provide, at his expense, a sump and a pump at the downstream end to remove the accumulated water. The use of water consolidation does not relieve the Contractor from the responsibility to make his own determination that such methods will not result in damage to existing improvements. The Contractor shall be responsible for any damage incurred. Where water consolidation is not permitted or does not result in adequate compaction, the backfill material shall be compacted with hand and/or mechanical work methods using equipment such as rollers, pneumatic tamps, hydro-hammers or other approved devices which secure uniform and required density without injury to the pipe or related structures. Where Type I backfill is required, water consolidation will not be permitted for non-granular material.

Municipality	**Supplements**
PH:	601.4.5.1 New Residential Development Areas: In a new development area, prior to paving and prior to opening the area to public traffic, the following deviation to water consolidation, bedding and compaction shall apply: (A) Water consolidation of non-granular material will be permitted at the Contractor's discretion and responsibility.

Municipality	**Supplements**
SC:	**601.4.5 Compaction Methods:** *Add the following paragraph:* For all PVC and HDPE sewer pipe, alignment and initial consolidation of bedding up to the springline of the pipe shall be accomplished and approved by the inspector before succeeding layers are placed. Final compaction may be accomplished as part of the compaction of the succeeding layer with the approval of the COS Field Engineering Manager or designated representative.

601.4.6 Specifications for Granular Material: For purposes of this specification, granular material shall mean material for which the sum of the plasticity index and the percent of the material passing a No. 200 sieve shall not exceed 23. The plasticity index shall be tested in accordance with AASHTO T-146 Method A (Wet Preparation), T-89 and T-90.

Municipality	**Supplements**
PH:	**601.4.6 Specifications for Granular Material:** For purposes of this specification, granular material shall be defined as material for which the sum of the plasticity index and the percent of the material passing No.200 sieve shall not exceed 23. The plasticity index shall be tested in accordance with AASHTO T-90.

Municipality	**Supplements**
SC:	**601.4.6 Specifications for Granular Material:** *Modify the first sentence of this paragraph to read as follows (Modified text is highlighted):* For purposes of this specification, granular material shall mean material for which the sum of the plasticity index and the percent of the material passing a No. 200 sieve shall not exceed 23. **For PVC sewer pipe (SDR 35) only, the percent of the material passing a No. 200 sieve may exceed 12 percent only when the plasticity index does not exceed 6.**

601.4.7 Rights-Of-Way Belonging to Others: Backfill and compaction for irrigation lines of the Salt River Valley Water Users' Association and Roosevelt Irrigation Districts and for trenches in State of Arizona and Maricopa County rights-of-way outside the limits of the Contracting Agency shall be accomplished in accordance with their permit and/or specifications.

Municipality	Supplements
PH:	**601.4.7 Rights of way Belonging to Others:** Backfill and compaction for irrigation lines of the Salt River Valley Water User's Association and Roosevelt Irrigation Districts and for trenches on State of Arizona and Maricopa County rights-of-way, outside the limits of the Contracting Agency, shall be accomplished in accordance with their permit and/or their specification.

601.4.8 Test Holes: Boring logs shown on the plans do not constitute a part of the contract and are included for the Contractor's convenience only. It is not intended to imply that the character of the material is the same as that shown on the logs at any point other than that where the boring was made. The Contractor shall satisfy himself regarding the character and amount of rock, gravel, sand, silt, clay and water to be encountered in the work to be performed.

Municipality	Supplements
PH:	**601.4.8 Test Holes:** Boring logs shown on the plans or included in the specifications do not constitute a part of the contract and are included for the Contractor's convenience only. It is not intended to imply that the character of the material is the same as that shown on the logs at any point other than that where the boring was made. The Contractor shall satisfy himself regarding the soils moisture content and the amount of rock, gravel, sand, silt, clay and water to be encountered in the work to be performed.

601.4.9 Foundation and Bedding for Electronic, Telephonic, Telegraphic, Electrical, Oil and Gas Lines: Foundation and bedding for these underground facilities shall be native material or sand which conforms to the grading requirement of ASTM C-33 for fine aggregate. When backfill material consists of aggregate base course, crushed stone, or other material containing stones, only sand will be used for foundation, and bedding. The foundation depth shall be six inches and bedding depth shall be one foot above the top of the facility. Compaction will be in accordance with Section 601.

Municipality	Supplements
PH:	**601.4.9 Foundation and Bedding for Electronic, Telephonic, Telegraphic, Electrical, Oil and Gas Lines:** Foundation and bedding for these underground facilities shall be native material or sand which conforms the grading requirement of ASTM C-33 for fine aggregate. When backfill material consists of aggregate base course, crushed stone, or other material containing stones, only sand will be used for foundation and bedding. The foundation depth shall be six inches and bedding depth shall be one foot above the top of the facility. Compaction will be in accordance with Section 601.

601.5 CONTRACTOR CERTIFICATION OF INSTALLATION PROCEDURES:

When requested in the Special Provisions or by the Engineer prior to installation, the Contractor shall furnish to the Contracting Agency an affidavit (certification) from the pipe manufacturer (or his designee) stating that the Contractor is familiar with the manufacturer's suggested installation methods and procedures and the installation complies with those procedures and is consistent with MAG requirements.

Also, when required in the Special/Technical Provisions or requested by the Engineer, the pipe manufacturer or his designee will review the Contractor's methods and procedures for pipe installation in the field. The Contractor will make any adjustments in the installation as recommended by the manufacturer or his representative. If necessary, the Contractor may be required to reinstall or provide corrections to pipe installed prior to the field review at no cost to the Agency. Once the manufacturer or his representative has reviewed the Contractor's installation methods and the Contractor has adjusted his installation methods as recommended by the same, the manufacturer or his representative shall furnish to the Contracting Agency an affidavit (certification) that the Contractor's installation methods and procedures, at the time of the review, complied with the manufacturer's installation practices. The affidavit must provide the name of the manufacturer's representative witnessing the pipe installation.

Municipality	Supplements
PH: has added the following	**601.5.1 Grading:** The Contractor shall do such grading in the area adjacent to backfilled trenches

Municipality	Supplements
PH:	**601.5.2 Restoring Surface:** All streets, alleys, driveways, sidewalks, curbs, or other surfaces in which the surface is broken into or damaged by the installation of the new work, shall be resurfaced in kind or as specified to the satisfaction of the Engineer in accordance with Section 336.

Municipality	Supplements
PH:	**601.5.3 Clean-Up:** The job site shall be left in a neat and acceptable condition. Excess soil, concrete, etc., shall be removed from the premises.

Municipality	Supplements
PH:	**601.5.4 Temporary Pavement:** The Contractor shall install temporary asphalt pavement or the first course of permanent pavement replacement in accordance with Section 336 immediately following backfilling and compaction of trenches that have been cut through existing pavement. Except as otherwise provided in Section 336, this preliminary pavement shall be maintained in a safe and reasonably smooth condition until required backfill compaction is obtained and final pavement replacement is ordered by the Engineer. Temporary paving removed shall be hauled from the job site and disposed of by the Contractor at no additional cost to the Contracting Agency.

601.6 PAVEMENT REPLACEMENT AND SURFACE RESTORATION:

Municipality	Supplements
PH:	**601.6 PAYMENT:** No payment item will be included in the proposal, nor direct payment made for trench excavation, backfilling, compaction or placement of temporary pavement. The cost of these features of the work shall be included in the unit price bid per linear foot for furnishing and laying pipe.

601.6.1 Grading: The Contractor shall do such grading in the area adjacent to backfilled trenches and structures as may be necessary to leave the area in a neat and satisfactory condition approved by the Engineer.

601.6.2 Restoring Surface: All streets, alleys, driveways, sidewalks, curbs, or other surfaces, in which the surface is broken into or damaged by the installation of the new work, shall be resurfaced in kind or as specified to the satisfaction of the Engineer in accordance with Section 336.

601.6.3 Cleanup: The job site shall be left in a neat and acceptable condition. Excess soil, concrete, etc., shall be removed from the premises.

601.6.4 Temporary Pavement: The Contractor shall install temporary asphalt pavement or the first course of permanent pavement replacement in accordance with Section 336 immediately following backfilling and compaction of trenches that have been cut through existing pavement. Except as otherwise provided in Section 336, this preliminary pavement shall be maintained in a safe and reasonably smooth condition until required backfill compaction is obtained and final pavement replacement is ordered by the Engineer. Temporary paving removed shall be hauled from the job site and disposed of by the Contractor at no additional cost to the Contracting Agency.

601.7 PAYMENT:

No pay item will be included in the proposal, nor direct payment made for trench excavation, backfilling, compaction, or placement of temporary pavement. The cost of these features of the work shall be included in the unit price bid per linear foot for furnishing and laying pipe.

ENCASEMENT OF WATER OR SEWER PIPE BY JACKING OR TUNNELING OPERATION

602.1 DESCRIPTION:

The Contractor shall furnish all labor, material and equipment as required to perform the jacking or tunneling operation in accordance with the plans and specifications.

In the performance of the work, the Contractor shall comply with the lawful requirements of the affected Contracting Agencies, owners of public utilities and any other facilities which might be endangered by jacking or tunneling operations.

602.2 GENERAL:

Unless otherwise provided for by the Contracting or Permitting Agency the Contractor shall be responsible for determining the required thickness of the steel liner plate or steel casing in accordance with the manufacturer's recommendations.

The inside diameter of the steel liner plate or steel casing shall be a minimum of 12 inches larger than the largest outside diameter of the carrier pipe or the size indicated on the plans, whichever is greater. No part of the plates or flanges shall be allowed to extend inside this net diameter. It shall be the responsibility of the Contractor to increase such dimension where necessary to provide placement room for pipe bells or to provide adequate space for grout placement.

The tolerances allowed for the alignment and grade of carrier pipe shall be the same as if it was being installed in a trench (Sections 610, 615 and 618).

The approach trench for jacking or tunneling operation shall be shored to safeguard existing sub-structure and surface improvements and to protect against ground movement in the vicinity of the jack supports or tunnel portal.

602.3 JACKING OPERATION:

Before starting operations, the Contractor shall submit in accordance with Subsection 105.2, detailed shop drawing of the jacking pit bracing, the casing, the jacking head, the carrier pipe installation method and the bracing to prevent carrier pipe flotation and shifting.

The casing shall consist of welded steel pipe (ASTM A-283 Grade C). Shop and field joints shall be butt weld. Fabrication and welding shall be in accordance with AWWA C-200. Weld or hydrostatic testing is not required.

The leading edge of the casing shall be equipped with a steel jacking head, securely anchored to prevent any wobble or alignment variation during the jacking operation. Excavation shall not be made in advance of the jacking head and every effort shall be made to avoid any loss of earth outside of the jacking head. Excavated material shall be removed from the casing as excavation progresses and accumulation of material within the casing shall not be permitted.

Once the jacking operation has started, it shall be continued around the clock until the specified limits have been reached.

On steel casing 36 inches or larger (I.D.), grout connections shall be provided at a maximum spacing of 10 feet. Upon completion of the jacking operation, all voids around the outside face of the steel casing shall be filled by grouting. Grouting equipment and material shall be on the job site before the jacking operations are completed so that grouting may be started immediately. Grout shall be placed by means of pumps capable of pressures up to 100 psi unless otherwise approved by the Engineer. Grouting pressure shall be controlled to approximately 10 psi so as to avoid movement of the ground around the steel casing. After grouting has been completed, the grouting connections will be closed with threaded steel plugs.

Steel casing smaller than 36 inches (I.D.) will not require outside grouting unless caving or earth movement occurs.

602.4 TUNNELING OPERATIONS:

Before starting operations, the Contractor shall submit, in accordance with Subsection 105.2, detailed shop drawing of the steel liner plate, method of installing the steel liner plates, tunnel dimensions, method of backpacking any cave-ins or overexcavation, carrier pipe installation method, and the bracing to prevent carrier pipe shifting and flotation.

Only steel liner plates will be used for tunnel support. All plates shall be punched for bolting on both longitudinal and circumferential seams or joints and shall be fabricated for erection inside the tunnel. Grout connections will be provided on the liner plates at a maximum distance of 10 feet. The entire periphery of the tunnel will be lined allowing no gaps between the liner plates. Excavation of the tunnel section shall be restricted to the least clearance required to permit erection of the liner plate. Every effort will be made to prevent any loss of ground and the Contractor shall perform the grouting operation at intervals not to exceed three rings of the liner plate. Grout shall be placed by means of pumps capable of pressures up to 100 psi. The placement pressure shall not, normally, exceed 10 psi to avoid deformation of the liner plate or the ground. After grouting has been completed, the grout connection will be closed with threaded steel plugs.

602.5 DEWATERING:

All water encountered during the jacking or tunneling operation shall be disposed of by the Contractor in such a manner as will not damage public or private property or create a nuisance or health problem. The cost of furnishing pumps, pipes and equipment for dewatering will be considered incidental to the work and no additional payment will be made.

602.6 CARRIER PIPE PLACEMENT:

Carrier pipe, larger than 24 inches (I.D.), shall be placed using pipes or rails for alignment and grade. Carrier pipe, 24 inches I.D. or less, may be placed using pipes, rails or wooden skids, at the Contractor's option. In either case, it shall be the Contractor's responsibility to obtain the required alignment and grade for the carrier pipe and to ensure that the carrier pipe does not draw or rest on the casing or liner plate.

After the carrier pipe has been placed and securely blocked to prevent shifting or flotation, the entire annular space shall be completely filled with grout.

If the Contractor is not ready to place the carrier pipe immediately following completion of the jacking or tunneling operation, the ends shall be protected with temporary bulkheads. The approach trench shall be backfilled in accordance with Sections 601 and 336.

After completion of the grouting operation, the Contractor shall remove all loose and disturbed material in the approach trench and backfill the trench in accordance with Sections 601 and 336.

602.7 MEASUREMENT AND PAYMENT:

Measurement for this work shall be at the ground surface and shall be the number of horizontal linear feet of ground surface undisturbed by the cut and cover construction on the ends of the steel casing or tunnel liner operation. Payment compensation for furnishing all labor, material, tools, and equipment required for the successful completion of the jacking or tunneling operation, including carrier pipe placement, in accordance with this Section.

INSTALLATION FOR HIGH DENSITY POLYETHYLENE PIPE

603.1 DESCRIPTION:

The work covered by this specification consists of furnishing all plant, labor, equipment, appliances and materials and performing all operations in connection with a large-diameter High Density Polyethylene (HDPE) pipe installation in accordance with the plans, specifications and special provisions.

For installation procedures of HDPE for sewer line construction, see Section 615.

For installation procedures of HDPE for storm drain construction, see Section 618.

HDPE pipe and fittings shall conform to Section 738.

This section covers large-diameter HDPE pipeline installations of gravity and low-pressure storm drain and sanitary sewer construction.

For the purpose of this specification, low-pressure is defined as the test pressures of 3.5 psi of air or 4 feet of water as specified in Section 615.10.

For the purpose of this specification, large-diameter HDPE pipe shall include 8 inches through 120 inches nominal diameter.

Municipality	Supplements
SC:	**603.1 DESCRIPTION:** *Add the following paragraph:* Written approval for the use of HDPE pipe shall be obtained from the Transportation Planning Division for storm sewers and culverts, and from the Water Resources Department for sanitary sewer installations.

603.2 EXCAVATION:

Excavation shall comply with Subsection 601.2. Trench widths shall comply with Subsection 601.2.2, Table 601-1 and Note (1) for HDPE pipe, meeting AASHTO M-252, and AASHTO M-294. Trench widths for profile HDPE pipe, meeting ASTM F-894, will be designed by the Engineer and included on the plans or in the special provisions.

Municipality	Supplements
SC:	**603.2 EXCAVATION AND COVER:** *Add the following paragraph:* The minimum cover for HDPE pipe shall be one (1) feet for all pipe diameters to the top of pavement. Trench excavation shall provide for a minimum of twelve (12) inches of clearance on either side of the pipe.

603.3 PROTECTION OF EXISTING UTILITIES:

Protection of existing utilities shall comply with Subsection 601.3.

603.4 FOUNDATION, BEDDING, BACKFILLING AND COMPACTION:

603.4.1 Foundation: Foundation shall comply with Subsection 601.4.1.

603.4.2 Bedding: Coarse aggregate shall be used for bedding of large-diameter profile HDPE pipe. Coarse aggregate shall be in accordance with Subsection 603.4.6, for size, type, and gradation. For corrugated HDPE pipe as defined under Section 738, bedding shall meet the requirements of subsection 601.4.2 and Table 601-2 with the compaction requirements stipulated below.

Bedding material shall be carefully deposited in 8 inches or less loose lifts, thoroughly and carefully compacted around the pipe, equally around both sides of the pipe, with approved vibratory compactors or other tools or equipment when applicable, or by shovel slicing as approved by the Engineer. This shall be repeated until enough material is placed and compacted to provide a minimum of one (1) foot cover over the top of profile HDPE pipe, or to the top of corrugated HDPE pipe. Compaction densities, as well as further compaction requirements shall be as stipulated in Table 601-2, unless shown otherwise on the plans.

Municipality	Supplements
MC:	Section 603.4.2 is modified as following: Controlled low strength material (CLSM) shall be used for bedding of HDPE. The CLSM shall be ½ Sack per Section 728 unless otherwise noted. Placement of the CLSM bedding shall be per Section 604 and extend to 12 inches above the pipe crown line.

Municipality	Supplements
SC:	**603.4.2 Bedding:** *Replace this section in its entirety with the following:* Course aggregate, crushed rock, or granular native soil may be used for bedding and backfill of HDPE pipe and shall comply with MAG Section 701 and MAG Table 702. If native soil is to be used, the Contractor shall provide at least three gradation tests per 1,000 linear foot of trench from the City's material testing company which illustrates compliance with the gradation requirements. Compaction of bedding backfill may be performed by water consolidation as provided in MAG 601.4.5. The minimum compaction requirements shall be as provided in MAG Table 601.2. Care shall be taken to avoid pipe flotation. Compacted backfill shall be placed in eight (8) inch lifts or less, compacted around the pipe with vibratory compactors. Lift placement and compaction shall be repeated until enough material is placed and compacted to provide a minimum of one (1) foot of cover over the top of the pipe.

603.4.3 Backfilling: Backfilling shall comply with Subsection 601.4.3.

603.4.4 Compaction Densities: Compaction densities shall comply with Subsection 601.4.4.

603.4.5 Compaction Methods: For large-diameter HDPE pipe installations where the backfill and bedding material is coarse aggregate, mechanical compaction shall be the only method for consolidating backfill and bedding. Water consolidation shall not be used as a method of compaction for coarse aggregate whether used as a foundation, bedding or backfill material.

For large-diameter pipe installations where the backfill material is other than coarse aggregate, consolidation shall be by mechanical means. Water consolidation may be used as a compaction method for the backfill material only when prior written approval to do so is provided by the Engineer.

603.4.6 Specifications for Material: Coarse aggregate shall consist of crushed rock as defined in Section 701 with 100 percent of the specified size of aggregate having one fractured face, and having the gradation complying with ASTM D-448, Table 1, Size Numbers 6, 67, 68, 7, 78, or 8 as recommended by the Engineer. The gradation size number to be furnished shall be shown on the plans or in the project specifications.

603.4.7 Rights-of-Way Belonging to Others: Rights-of-way belonging to others shall comply with Subsection 601.4.7.

603.4.8 Test Holes: Test holes shall comply with Subsection 601.4.8.

603.4.9 Foundation and Bedding for Electronic, Telephonic, Telegraphic, Electric, Oil and Gas Lines: Foundation and bedding for electronic, telephonic, telegraphic, electric, oil and gas lines shall comply with Subsection 601.4.9.

603.5 PREPARING AND INSTALLING HDPE PIPE:

603.5.1 Storage and Handling: Pipe shall be stored and handled in such a way to minimize out-of-roundness. Pipe shall be stored in shaded areas to minimize adverse effects of thermal, and ultraviolet exposure.

Pipe that is out-of-round in excess of 3% of the nominal pipe diameter as specified in Section 738, shall not be installed and shall be removed if installed.

603.5.2 Strutting: Strutting of Profile HDPE pipe per Section 738 will be required when the diameter is 42 inches or larger. For Profile HDPE pipe with diameters smaller than 42 inches, strutting may be required at the discretion of the Engineer. Strutting of

Corrugated HDPE pipe per Section 738 is not required.

Strutting consists of placing wood struts, whose length is typically 3% longer than the nominal pipe diameter, inside the pipe. A minimum of three (3) sets of struts are placed in each pipe length, oriented vertically, spaced equally throughout the length of pipe and set so as not to interfere with the jointing of the pipe. The struts shall be kept in place until the bedding material is placed and compacted around the pipe. The struts must be removed before any backfill or bedding is placed above the pipe. The procedure of strutting the pipe shall not damage the pipe in any way. If the pipe is out of round, the struts will be placed in the long direction of the out-of-round. If the strut cannot be held in place by the pipe, the pipe will be removed from the job site per Subsection 738.9.

603.5.3 Orienting: If the pipe is out-of-round, the pipe should be oriented so that the long axis is placed vertically when installed in the trench. When struts are used, the struts shall be oriented vertically when pipe is installed in the trench.

603.5.4 Installing Pipe: HDPE pipe and fittings shall be installed in accordance with ASTM D-2321 or manufacturer's recommendation. HDPE pipe shall be handled so as not to damage the pipe. Hoisting shall be accomplished with cloth belt slings or ropes. The pipe shall be protected by wood blocking when jointing is accomplished by pipe jacking, back hoe bucket, come-along, or cable pipe puller.

Municipality	Supplements
SC:	**603.5.4 Installing Pipe:** *Add the following paragraph:* Whenever corrugated HDPE pipe is interfaced with concrete or concrete structures, a heavy coat of "Noah's" pitch shall be applied around the pipe to be in contact with the concrete. "Ram-Nek", or approved equal, shall then be wrapped around the pipe over the "Noah's" pitch prior to placement of the concrete. A waterstop gasket may be used only after written approval is obtained from the City.

Municipality	Supplements
SC: has added the following	**603.5.6 Deflection Test and Inspection:** MAG Subsection 615.10 (C) and (D) shall also apply to HDPE storm drain installations. MAG Subsection 615.10 (D) may be waived for storm drain installations only if the Engineer determines that a visual inspection is permissible. The maximum permitted HDPE pipe deflection shall be five (5) percent of the nominal pipe diameter. Any pipe found to exceed the deflection standard shall be removed or repaired. If required by the Engineer, the Contractor shall mandrel all installed HDPE pipe in the presence of a City Inspector, or may submit an alternate deflection measurement technique to Transportation Planning for approval. The Contractor shall perform another mandrel test on the removed or repaired section. Testing results and certification, if required, shall be provided to the Transportation Planning Department in the case of storm sewers or culvert installations.

603.6 PAVEMENT REPLACEMENT AND SURFACE RESTORATION:

Pavement replacement and surface restoration shall comply with Subsection 601.5.

603.7 PAYMENT:

No pay item will be included in the proposal, nor direct payment made for trench excavation, backfilling, compaction, or placement of temporary pavement. The cost of these features of work shall be included in the unit price per bid per linear foot for furnishing and laying pipe.

PLACEMENT OF CONTROLLED LOW STRENGTH MATERIAL

604.1 DESCRIPTION:

The work covered by this specification consists of furnishing all materials, labor and equipment for the placement of controlled low strength material (CLSM).

The following is a brief description of the types of controlled low strength material (CLSM) and their intended uses:

1/2 SACK: One half sack CLSM can be used as a general trench backfill in areas where future excavation into the backfill is anticipated or in areas of low loading such as streets, parking areas, behind retaining walls, etc.

1 SACK: One sack CLSM can be used as a general trench backfill and backfill behind retaining walls where additional strength is required above that of 1/2 sack CLSM.

1 1/2 SACK: One and one half sack CLSM can be used as a structural backfill under foundations and as thermal fill and/or mechanical protection of duct banks and conduits.

The type of backfill to be used shall be as specified in the special provisions, plans or by the Engineer.

Municipality	Supplements
PH:	604.1 Description: Subsection 604.1 is modified to read: The work covered by this specification consists of furnishing all materials, labor and equipment for the placement of controlled low strength material (CLSM). The following is a brief description of the type of controlled low strength material (CLSM) and its intended use: ½ SACK: One half sack CLSM can be used as a general trench backfill in areas where future excavation into the backfill is anticipated or in areas of low loading such as street, parking areas, behind retaining walls, etc. The one half sack DLSM shall be identified by the product code PHCLSM. Only ½ Sack is allowed, unless specified in the special provisions, plans or by the Engineer

604.2 MATERIALS:

Controlled low strength material shall conform to the requirements of Section 728.

604.3 PLACEMENT:

The controlled low strength material shall be placed directly into the excavation. The CLSM shall be placed in a uniform manner that will prevent voids in or segregation of the material. Foreign material which falls into the trench prior to and during placing of the CLSM shall be immediately removed. The CLSM shall have consistency, workability, plasticity, flow characteristics and pumpability (when required) such that the material when placed is self-compacting. Mechanical compaction or vibration may be used to consolidate around structures, pipes, multiple conduits, etc., otherwise no mechanical compaction or vibration shall be required.

When CLSM is used for backfill around pipes or conduits, the CLSM shall be placed equally on both sides of pipe or conduit to prevent lateral displacement. Also, the CLSM shall be placed in lifts. The height of each lift shall not exceed the depth that will cause floating of the pipe or conduit. When placing the CLSM in greater lift depths, sufficient anchorage shall be provided so the pipe or conduit will not float.

Where CLSM is used for backfill around pipes or conduits with a depth less than 20 feet, the width of the excavation shown on the plans or in Section 601 may be reduced so that the minimum clear distance between the outside of the pipe or conduit and the side of the excavation (each side) shall be 12 inches for pipes or conduits 42 inches and larger, 6 inches for pipes or conduits between 4 inches and 42 inches and 3 inches for pipes or conduits 4 inches and smaller.

When CLSM is used behind retaining walls, the depth of each lift shall be limited so it will not induce hydraulic loads greater than the design loads.

For long trenches or installations which require a large amount of CLSM, bulkheads of wood, dirt, sand bags, etc. can be used to control the material's flowability. The bulkhead shall be removed prior to the continuation the backfilling.

CLSM shall NOT be permitted to come in contact with any aluminum, copper or brass materials, e.g., aluminum pipes or culverts, copper water pipe, saddles, fittings, etc. Protection shall be any combination of the following: place a layer of noncorrosive material around the pipe e.g., native material, import material, etc. or provide a protective covering or wrapping such as polyethylene wrap per Section 610.5. Pipes smaller than 4 inches can be completely wrapped with tape as per Section 610.5 or approved equal.

Generally, CLSM does not resist freezing and thawing and in some cases may propagate the condition. Further testing may be required prior to placing the material in a freeze-thaw condition.

604.4 PROTECTION:

When CLSM is placed within the traveled way or otherwise to be covered by paving or embankment materials, the material shall achieve a penetration resistance of 3 inches (indentation diameter) or less with 5 drops at a drop distance of 5 inches prior to covering and opening to traffic or the installation of the surface be delayed for 12 hours, which ever occurs first. Penetration resistance shall be as measured by ASTM Test Method D-6024, "Standard Test Method for Ball Drop on Controlled Low Strength Material to Determine Suitability for Load Application."

When CLSM is placed in foundation excavations, the material shall be protected from foundation loading and placement of foundation concrete prior to having reached initial set per ASTM C-403, or allowed to set in place for 24 hours, whichever occurs first.

Where the Engineer has identified soils as being moisture sensitive, a drainage notch or drain wick shall be placed longitudinally along the centerline of the trench or CLSM placement. The notch or wick shall be constructed within the first hour following placement. Drainage water shall be collected and removed at the end of notch or wick.

604.5 ACCEPTANCE:

CLSM shall be considered deficient and may be rejected at the discretion of the Engineer if:

(A) The CLSM is outside of the limits specified in Table 728-1 and/or

(B) The aggregate gradation is outside the limits specified in Section 701.3.5.

Rejected material not placed shall be immediately removed from the job site. Rejected material placed shall be removed and replaced with acceptable material. Removing and disposing of the rejected material shall be at no additional cost to the Contracting Agency.

604.6 PAYMENT:

No pay item will be included in the proposal nor direct payment made for CLSM. The cost for placing the material shall be included in the unit price bid for the specific work function (laying pipe, placing structure foundation, construction retaining wall, etc.).

SUBDRAINAGE

605.1 DESCRIPTION:

The subdrainage system shall be constructed in accordance with the notes and details shown on the plans and the applicable provisions of these specifications except as modified in the special provisions.

605.2 CONCRETE:

All concrete placed in drainage structures, subdrain outlets, pipe collars, and similar features of the subdrainage system shall conform to the applicable provisions of Section 725.

605.3 SUBDRAINAGE PIPE:

Subdrainage pipe, both perforated and non-perforated, shall be either bell and spigot concrete, bell and spigot vitrified clay, corrugated metal pipe, or asbestos-cement pipe as shown on the plans or specified in the special provisions. However, if the particular kind of pipe is not shown on the plans nor specified in the special provisions, subdrainage pipe shall be concrete pipe of at least standard strength quality and shall conform to the requirements of Section 736. Vitrified clay pipe shall conform to the requirements of Section 743. Asbestos-cement pipe shall conform to the requirements of Section 737. Corrugated metal pipe shall conform to the requirements of Section 760.

605.3.1 Pipe Joints: Unless the pipe joints are of a self-aligning type, have the bottom half of the bell joint filled with mortar to securely hold the pipe in alignment and to bring the inner surface of abutting pipes flush and even. Where a tight joint for non-perforated pipe is required, the bell joint shall be completely filled with mortar.

Asbestos-cement pipe joints shall be made with couplings in accordance with the recommendations of the pipe manufacturer.

605.4 SUBDRAINAGE MANHOLES:

Subdrainage manholes, including inlets, outlets, flap gates, gate boxes, and drop steps, shall comply with the requirements of the plans and the special provisions.

605.5 FILTER MATERIALS:

The filter materials shall be placed within the limits shown on the plans. The compositions of the filter materials shall each conform to one of the grading requirements in Table 605-1; the particular requirement to be used will be specified in the special provision.

The materials used shall conform to requirements for concrete aggregates in Section 701; however, the requirements for grading, and reactivity, as stated therein, shall not apply. The minimum bulk specific gravity shall be 2.50, by ASTM C-127.

TABLE 605-1

FILTER MATERIAL GRADING - % PASSING

Screen or Sieve Size	TYPE		
	F1	F2	F3
3/4″		100	100
3/8″	100	80 - 100	70 - 100
No. 4	90 - 100	60 - 85	45 - 75
No. 8	75 - 90	45 - 70	30 - 60
No. 16	55 - 80	30 - 55	20 - 45
No. 30	30 - 60	15 - 40	10 - 30
No. 50	10 - 40	5 - 20	0 - 15
No. 100	0 - 15	0 - 10	0 - 5
No. 200	0 - 5	0 - 5	

605.6 PLACEMENT:

605.6.1 General: The excavated subgrade shall be kept free of surface water. Mudholes, ruts, or soft spots due to the Contractor's operations shall be repaired at no additional cost to the Contracting Agency, as ordered by the Engineer.

Filter and drain material shall be placed around drainage pipe so as to provide even support throughout the entire length of the pipe and to permit the installed pipe to lie upon true alignment and grade. The minimum thickness of filter material surrounding the pipe shall be 6 inches.

Filter material shall be spread to such depth as to obtain the required thickness after compaction and shall be uniform and true to the line and grades indicated on the plans.

The surface under sloped bank lining or invert shall not show any variation or departure greater than 1/2 inch from the testing edge of a 10 foot straightedge. Ridges and humps shall be regraded, depressions filled and compacted, and tested for straightness until grading is accomplished within the tolerance specified. No relative density will be required.

Pipe damage during placement or compaction shall be replaced by the Contractor at no additional cost to the Contracting Agency. The Contractor shall exercise due care to prevent water from surface drainage or other sources, mud, muck, or debris, from running into the filter material both during and after its placement, until the lining, backfill, or structure placed thereon is completed or set. The Contractor shall provide and operate drainage sumps and pumps, or equivalent means satisfactory to the Engineer, to prevent any such saturations of the filter materials.

605.6.2 Under Sloped Bank Lining: Those portions of filter materials which become subgrade for sloped bank lining shall be compacted by 4 passes of a small roller weighing not less than 600 pounds, and 20 pounds per inch of roller width, or by other means approved by the Engineer.

605.6.3 Under Invert: Those portions of filter materials which become subgrade for channel invert linings shall be compacted by 2 passes of a smooth-wheeled roller lapping 1 foot each pass, or by use of manually-operated hand tampers, or by other means as approved by the Engineer. The weight of the roller or the size of the tamper shall be approved by the Engineer.

605.6.4 In Trenches and Along Heels or Walls of Sides of Structures: The filter materials shall be placed in 1 foot lifts and compacted by hand-held tamping or vibrating equipment to the satisfaction of the Engineer.

605.7 TESTS OF THE SUBDRAINAGE SYSTEM:

Two separate tests shall be made on each subdrain line by the Contractor to assure the proper functioning of the subdrainage system. Each test shall be conducted in the presence of the Engineer and shall consist of the flushing of the subdrain line with sufficient water to develop a flow of 5 cubic feet per minute out of the end of the line being tested, as measured by approved measuring equipment furnished by the Contractor.

When a channel invert slab is required, the first test of each completed section of the subdrain system shall be performed immediately prior to the placement of reinforcing steel for the channel invert slab and the second test shall be performed after completion of the channel invert work. Manholes shall be cleared of all debris prior to beginning the second test.

Final acceptance of the subdrainage system will be made only if the discharge is of uniform flow and of adequate quantity. Any necessary clearing of drain lines to meet the above requirements shall be performed by the Contractor at no additional cost to the Contracting Agency.

All costs involved in the performance of the tests, including the furnishing of all labor, equipment, and material required therefore, shall be included in the prices bid for the items under which the subdrainage system is to be constructed.

605.8 PAYMENT:

Payment for the work included in this specification will be made on the basis of the lump sum or unit prices stipulated in the proposal, unless the payment for subdrainage work is included in the cost for other improvements. Such payment shall include full compensation for furnishing all labor, tools, and equipment and incidentals for doing the work involved.

WATER LINE CONSTRUCTION

610.1 DESCRIPTION:

The construction of all water lines shall conform to applicable standard specifications and details, except as otherwise required on the plans or as modified in the special provisions.

610.2 GENERAL:

All pipe shall be delivered, handled and installed in accordance with the manufacturer's recommendations and/or applicable provisions of AWWA standards for installation of the various types of water mains specified, insofar as such recommendations and provisions are not in variance with the standard specifications and details.

Where water lines are to be constructed in new subdivisions or in conjunction with street repaving projects, the streets shall be pre-graded to within 6 inches of the new street subgrade prior to trenching or cut stakes shall be set for trenching.

Municipality	Supplements
CH:	**SPECIFICATION NO. 10** **STANDARDS FOR** **WATER PIPE AND FITTINGS** **4" THROUGH 16" DIAMETER** 1. **GENERAL:** These specifications apply to Polyvinyl Chloride (PVC) pressure pipe intended for use as potable water distribution pipelines, which carry water under pressure.

610.3 MATERIALS:

All pipe for water lines shall be of the classes shown on the plans or as specified below.

(A) The 4 inches through 16 inches diameter pipe may be asbestos-cement or ductile iron, except where a particular material is specified. All pipe shall be minimum 150 P.S.I. design unless otherwise specified.

(B) Pipe 16 inches and larger may be either ductile iron, or concrete pressure pipe-steel cylinder type.

Ductile iron water pipe and fittings - Section 750. Asbestos-cement water pipe and fittings - Section 752. Concrete pressure pipe-steel cylinder type - Section 758.

Municipality	Supplements
CH:	**SPECIFICATION NO. 10** **STANDARDS FOR** **WATER PIPE AND FITTINGS** **4" THROUGH 16" DIAMETER** 2. **MATERIAL:** 4 inch through 12 inch PVC pressure pipe shall be designed, manufactured and tested in accordance with AWWA C-900, latest edition. The barrel of furnished pipe shall conform to the outside dimensions of steel pipe (IPS) or cast-iron-pipe-equivalent (CI), and with the wall thickness of dimension-ratio (DR) Series 14. All approved PVC pipe shall carry a NSF rating. The pressure rating for C-900 pipe shall be 200 psi minimum. 16 inch PVC pressure pipe shall be designed, manufactured, and tested in accordance with AWWA C-905, latest edition. The barrel of furnished pipe shall have an iron-pipe-size-equivalent (IPS) outside diameter and wall thickness equal to the dimension-ratio (DR) Series 18.

The pressure rating for C-905 pipe shall be 235 psi.

All PVC pipe furnished shall be integral bell with elastomeric gaskets. Plain ends with elastomeric gasket couplings will be allowed only for intermediate pipe lengths. PVC joints using elastimeric gaskets to achieve the pressure seal shall be tested as assembled joints and shall meet the laboratory performance requirements specified in ASTM D3139.

A Manufacturer's Affidavit for compliance to AWWA C-900 and AWWA C-905 shall be furnished. The manufacturer shall provide documentation of the long-term compressive strength of the pipe material, or the long-term hydrostatic design strength, which shall be certified by an independent third party.

All required manufacturing quality control inspection and testing shall be performed in the United States of America at the pipe manufacturer's plant or at an approved testing laboratory in the United States. The seal of the testing agency that verified the suitability of the pipe material for potable water service shall be marked on the pipe. In addition, markings on the pipe shall include the following:

A. Nominal size and OD base
B. Material code designation
C. Dimension ratio number
D. AWWA pressure class
E. AWWA designation number for this standard
F. Manufacturer's name or trademark and production record code.

Pipe shall be supplied within 270 days of its manufacture. A Manufacturer's written Verification of date of manufacture shall be provided.

A. **610.3 MATERIALS**

All pipe for water lines shall be of the classes shown on the plans or as specified below.

(A) 4 inch through 12 inch pipe may be ductile iron or polyvinyl chloride, except where otherwise specified.

(B) 14 inch through 16 inch pipe may be ductile iron, concrete cylinder pipe, or polyvinyl chloride pipe as specified in the standards for 14 inch to 16 inch diameter transmission pipe, and in accordance with AWWA C-905 standards.

(C) Pipe sizes greater than 16 inches may be either ductile iron or concrete pressure pipe - steel cylinder type.

Municipality	Supplements
TE:	All water lines 6" through 16" shall be ductile iron pipe, class 52.

Municipality	Supplements
PH:	610.3 Materials: Subsection (B) is changed to read: (B) Pipe eighteen (18) inches and larger may be either ductile iron, or concrete pressure pipe - steel cylinder type.

Municipality	Supplements
SC:	**610.3 MATERIALS:** Polyethylene and polybutylene material shall not be used in any water system installation.

610.4 CONSTRUCTION METHODS:

All water mains in major streets shall have a minimum cover of 48 inches over the top of the pipe. Water mains in other locations shall have a minimum cover over the top of the pipe as follows:

(A) 36 inches for mains smaller than 12 inches.

(B) 48 inches for mains 12 inches and larger.

Cover for water mains will be measured from existing or proposed finished grade of pavement or from natural ground, whichever is deeper.

No water main shall be deflected, either vertically or horizontally, in excess of that recommended by the manufacturer of the pipe or coupling, without the appropriate use of bends or offsets.

If adjustment of the position of a length of pipe is required after it has been laid, it shall be removed and rejoined as for a new pipe.

Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the line. At all times when a pipe laying is not in progress, the open ends of the pipe line shall be closed by a water-tight plug or other means approved by the Engineer.

Where restrained joints are specified on mains sixteen (16) inches in diameter and smaller, ductile iron pipe shall be used with an approved joint restraint method.

Municipality	Supplements
SC:	**610.4 CONSTRUCTION METHODS:** All horizontal water line deflections shall be marked with electronic locators which shall be self-leveling type, operate at a frequency of 145.7 kHz and be capable of detection to a depth of 4 feet.
Municipality	**Supplements**
CH:	**SPECIFICATION NO. 10** **STANDARDS FOR** **WATER PIPE AND FITTINGS** **4" THROUGH 16" DIAMETER** 3. **WORKMANSHIP:** Pipe shall be homogeneous throughout. It shall be free of voids, cracks, inclusions, or other defects. It shall be as uniform as commercially practical in color, density, and other physical properties. Pipe surfaces shall be free from nicks and scratches. Joining surfaces of spigots and other joints shall be free from gouges and imperfections that could cause leakage. The contractor shall supply the Engineer with certified third party test data establishing both the long-term compressive strength and the long-term modulus of elasticity of the PVC material. B. **610.4 CONSTRUCTION METHODS** Polyvinyl Chloride pipe shall be installed in accordance with the AWWA Manual 23. When polyvinyl chloride is used, a locator tape shall be buried 18 inches below the ground surface on top of the approved bedding material. The backfill shall be

sufficiently leveled so that the tape is installed on a flat surface. The tape shall be entered in the trench with the printed side up. Care shall be taken to avoid displacement of the tape and to ensure its integrity. (A) Locator Tape: Detectable pipe locating tape shall be a minimum 4.0 mils thick, inert polyethylene plastic that is impervious to all known alkalis, acids, chemical reagents and solvents likely to be encountered in the soil, with a minimum 1/3 mil thick metallic foil or two embedded copper wires. The tape shall be a minimum three inches in width. Locating tape shall be solid blue in color with the following message printed thereon: **'CAUTION WATERLINE.'** The tape message shall be legible and imprinted continuously over the entire length in permanent black lettering with the message length 18 inch maximum. The lettering shall be a minimum 1-1/2 inches high. The spacing between the individual words of the message shall be three inches maximum. The locator tape ends shall be placed at the top of the valve boxes to encourage easy pipe location.

Locator wire shall be run continuous along and attached to the PVC pipe. The wire leads shall be run into each valve box. Embedded copper wire shall be tested with a conductive locator for continuity over the full length of the pipe run prior to placement of backfill material.

4. **APPLIED LOAD CALCULATIONS:**

Assumption of soil arching shall not be used in calculation embankment loads over PVC pipe. The prism earth load formula shall be used to determine earth loads.

$$W_c = HwB_c$$

Where:

W_c = Embankment Load, lbs/ft
H = Depth of soil cover, ft
w = Soil Density, lbs/ft
B_c = Pipe outside diameter, ft

5. **BEDDING:**

Pipe bedding shall be in conformance with MAG Standards Section 601.4.2 and as further specified by the City of Chandler Standard Detail C-308. Sand, gravel, or crushed rock material of a single graduation shall not be used for bedding within the pipe zone. The design engineer shall determine the suitability of native *insitu* soils as bedding material using the H20 Highway Loading curve, the soil type, plasticity index, and sieve analysis to ensure proper structural stability of the pipe/trench system. The *insitu* soil shall be shown to provide structural stability as a side wall support system for the pipe, and shall contain no more than 12 percent by weight passing the No. 200 sieve. The *insitu* soil shall conform to Section 702, Table 702-1 of the *Maricopa Association of Governments Uniform Standard Specifications for Public Works Construction.*

6. **FITTINGS:**

Fittings shall be ductile iron and conform to AWWA C-110 or C-153 for 250 psi minimum working pressure rating.

All fittings shall be cement lined in accordance with AWWA C-104.

Fittings which require transition gaskets to ductile iron pipe sizes may be furnished only in sizes 6 inch through 8 inch.

PVC connections to asbestos cement or ductile iron pipe shall be ductile or gray iron adapters.

	7. **STORAGE:** Storage of PVC pipe shall be in accordance with the manufacturer's recommendation and guidelines. PVC pipe and fittings shall be stored in a dry, ventilated area that protects the pipe form UV radiation and the elements. Pipe stockpiled at the construction site shall not remain exposed to the elements and weather in excess of 24 hours, or as approved by the Engineer. PVC pipe shall be delivered to the site and stored and handled in accordance with the manufacturer's instructions. During shipment and storage, the pipe ends shall be securely covered. PVC pipe shall be stored in a manner such that it is protected from exposure to sunlight and/or extreme heat.

On mains sixteen (16) inches in diameter and larger where plans specify welding joints and where ductile iron pipe is furnished, joints shall be restrained by an approved joint restraint method for the distance specified.

Except as otherwise required in this specification, the special provisions, or by the Engineer, trench excavation, backfilling and compaction shall be in accordance with the requirements of Section 601. Backfilling may be accomplished as soon as the pipe line has been installed to the satisfaction of the Engineer, subject to the requirements for testing, as contained below.

Hydrostatic testing shall be in accordance with this specification.

All corporation stops used for testing and chlorination shall be left in the pipe line with the stop closed and all connecting pipe removed.

Curb stops with flushing pipes or fire hydrants shall be installed at the ends of dead-end mains according to standard details.

Thrust blocks shall be installed in accordance with this specification.

Valve boxes and covers shall be according to standard details.

Asbestos-cement pipe shall be installed in accordance with AWWA C-603, except pipe and fittings shall be in accordance with Section 752.

Cast iron pipe shall be installed in accordance with AWWA C-600, except pipe and fittings shall be in accordance with Section 750.

Ductile iron pipe shall be installed in accordance with this specification and pipe and fittings shall be in accordance with Section 750.

Municipality	**Supplements**
PH:	**610.4.1 Construction Work by City Forces:** (A) City forces shall perform all valve cut-ins, waterline shutdowns, and wet taps that are necessary for construction. The Contractor shall contact the inspector to make the necessary arrangements to have the City forces perform the required work. With the exception of permit work, there will be no charge for valve cut-ins, waterline shutdowns, and wet taps that are necessary for construction. For any valve cut-ins, waterline shutdowns, or wet taps requested by the Contractor, which are not necessary and are for the convenience of construction, the Contractor shall make application and pay the required charges to the Contracting Agency. On permit work, the Contractor shall pay all costs incurred.

	(B) When an existing waterline, other than as noted on the plans, conflicts with any proposed new work in the contract and no provision has been made in the proposal for relocating such lines, the City has the option to make any necessary adjustments or relocations, alter the proposed new work or negotiate with the Contractor for relocating the obstructing line.

Municipality	**Supplements**
PH:	**610.4.2 Construction work by Other Utility Owners:** Except as otherwise provided in the plans or project specification, all utilities in conflict with the new work will be relocated by the owner thereof. Mountain Bell and Arizona Public Service Company will adjust their manholes. In the event of an unanticipated conflict between the new work and a utility and the owner thereof disclaims responsibility for relocation, the City will negotiate with the owning utility and the conflict shall be resolved without extra cost to the Contractor. It will be necessary for the Contractor to coordinate his work with the utility companies in the relocation of their facilities during construction

Municipality	**Supplements**
PH:	**610.4.3 Construction Work by the Contractor:** (A) The Contractor shall adjust valve and meter boxes to final grade as described in Section 345 and the City of Phoenix Supplement. All valve boxes, manhole covers, etc., shall be adjusted after the asphalt concrete base is placed and prior to placing the 1-1/2 inch of asphalt concrete finishing course. (B) Where the centerline of the new waterline parallels the existing curb and gutter and is approximately two feet from the lip of the gutter, the Contractor shall remove and replace the pavement to the lip of the gutter. The Contractor will be paid for the extra pavement replacement in addition to the normal pavement re-placement over the pipe trench in accordance with MAG Section 336. (C) The Contractor shall accomplish the cutting and plugging of City water mains, where required on the plans, in accordance with City of Phoenix Detail P1343. The cuts and plugs will remain exposed until line pressure is restored and they can be inspected for leakage. The Contractor shall schedule the restoration of line pressure through the Engineer. Payment shall be at the unit bid price or lump sum bid price for "CUTTING AND PLUGGING EXISTING WATER LINES." This payment shall be full compensation for material, labor, tools and equipment necessary to complete the work. (D) Unless otherwise noted on the plans, the Contractor shall relocate existing water service lines and meters and remove or relocate fire hydrants. Unless other adequate provisions are made for fire protection, a fire hydrant will not be out of service for a period exceeding 24 hours. When relocating water meters which utilize either galvanized or polyethylene service pipe (or any other non-standard service pipe) the entire service piping shall be replaced using the approved service pipe material for that particular meter size. The existing corporation stop can be used provided and approved copper pipe adapter is used. Approved adapters are the Ford C04-43 and C04-54 conversion assembly or equal

Municipality	Supplements
PH:	**610.4.4 Approved Water Service Components:** Approvals shown are not necessarily exclusive. If approval of a similar device, believed to be comparable and equal, is desired, a request should be submitted supported by appropriate information and data. If general approval is desired, request should be submitted directly to the Water Services Department.

CORPORATION STOPS

Manufacturer	Copper Services	W/Dielectric Insulation
FORD	P-1600	F-1000
HAYES		
JONES	J-3401	
McDONALD	4701 T	
MUELLER		H-15007

ADAPTERS

Manufacturer	IPS Copper, Ell
FORD	L-84-33 L-84-44
HAYES	
JONES	J-2619
MUELLER	
McDONALD	4779 MT

Manufacturer	Curb Stops*	Metering Coupling
FORD	B-11-333 B-11-666 B-11-444 B-11-777	SPM-2R
JONES	J-1900	J-130 J-134
McDONALD	6101	4622 or 4624
MUELLER	H-10283 B-10291	H-10890 H-10891
HAYES	4000	5680 or 5682

*Heads of all curb stops shall be drilled 1/4" diameter for locks.

Municipality	Supplements
PH:	**610.4.5 Concrete Pressure Pipe - Steel Cylinder Type:** Where concrete, steel cylinder, pressure pipe is installed the following shall apply: (A) General: (1) The Contractor shall mortar the inside and outside of all pipe joints. The mortar shall be applied in the field on the inside joints such that the mortared surface is flush with the adjacent pipe mortar lining. The outside of the joints shall be mortar coated by the diaper method. The mortar shall be a Type "M" mortar per MAG 776 using Type II, low alkali cement.

	(2) All non-mortar coated steel, including flanges, shall be covered with a minimum of two (2) inches of hand-packed mortar. Wire mesh shall be used to hold the mortar in place. Mortar shall be the same as applied to the joints. Field-applied coal tar coatings will not be accepted in lieu of mortar. Except, coat tar enamel in accordance with AWWA C-203 shall be applied to the non-mortar coated steel and flanges on the 24" side outlets in access manholes. (3) Joint restraints shall be provided by means of welded joints. The extent of welded joints shall be as shown on the pipeline and layout drawings, and shall in no case be less than that shown on the plan drawings. Where welded joints are required, the weld shall be continuous about the entire circumference of the pipe joint. Welds shall be made intermittently, in short sections of about six (6) inches, to avoid overheating the gaskets on points where a gasket is used. Welds shall conform to that shown on the approved shop drawings and calculations.

Municipality	**Supplements**
PH:	**610.4.6 For mains eighteen (18) inches and larger, the following shall apply:** (A) Backfill and compaction for the full distance encompassed by welded/restrained joints shall be completed prior to testing. (B) All mainline valves shall be covered with a minimum of two (2) inches of hand-packed mortar. Wire mesh shall be used to hold the mortar in place. Field applied coal tar coatings will not be accepted in lieu of mortar. Portions of valves within manholes shall not be mortar coated. The mortar shall be a Type "M" mortar per MAG 776 using Type II, low alkali cement. (C) Where plans call for welding joints and ductile iron pipe is furnished, the Contractor shall restrain the joints by an approved joint restraint method.

Municipality	**Supplements**
PH:	**610.4.7** Where restrained joints are specified on mains less than eighteen (18) inches in diameter, ductile iron pipe shall be used with an approved joint restrain method.

Municipality	**Supplements**
PH:	**610.4.8 Joints in fire hydrant "run-out" piping to conform to 750.3.** All joints in the fire hydrant "run-out" from the main through the shut-off valve shall be restrained by an approved joint restraint method.

Municipality	**Supplements**
PH:	**610.4.9 Payment for Water Used During Construction:** The Contractor shall pay for all water used during the course of construction. This cost shall be included in the unit bid price for pipe. The final fill of the pipeline with replacement water shall not be included in the cost. Water rates shall be obtained from the Water Services Department - Accounting Division (602) (262-6687). Measurement will be through a fire hydrant meter or, if this is not possible, calculated by one of the procedures listed below: (A) Unmetered water used for testing, flushing and chlorination shall be calculated on a cubic foot basis, using the volume per foot pipe multiplied by the number of times the pipe is filled and by the total length of pipe installed for each hydrostatic test, flushing and chlorination procedure. If any additional testing, flushing or chlorination is required, because of failure to meet any of the above conditions, the volume of water used for each procedure shall be calculated as on the above basis for first procedure.

FOR ONE FOOT LENGTH OF PIPE

Diameter (Inches)	Cubic Feet	Gallons	Gallons Per Mile
3	.0491	.3673	1,939
4	.0873	.6528	3,447
6	.1963	1.469	7,756
8	.3490	2.611	13,786
10	.5455	4.081	21,547
12	.7854	5.876	31,025
14	1.069	7.977	42,224
16	1.396	10.44	55,123
18	1.767	13.22	69,802
20	2.182	16.32	86,170
24	3.142	23.50	124,080
30	4.909	36.72	193,882
36	7.069	52.88	279,203
42	9.620	71.96	379,950
45	11.044	82.62	436,233
48	12.566	94.02	496,326
54	15.90	118.97	628,162
60	19.63	146.88	775,526
66	23.76	177.72	938,362
72	28.27	211.44	1,116,403

(B) Unmetered water used for settling trench backfill for small waterlines 12" and less in diameter shall be estimated at a volume of 2.66 cubic feet of water per linear foot of trench settled.

(C) Water used for settling trench backfill on waterlines 14" and larger, shall be metered by a fire hydrant meter, or other means approved by the Engineer.
Subsection 610.8 FIRE HYDRANTS: is modified to add:

Except where otherwise required on the plans, the City of Phoenix will furnish the Contractor fire hydrants without cost for City of Phoenix projects. To secure the hydrants, the Contractor shall obtain a permit at the Water **Distribution Special Operations office at 3045 S. 22nd Avenue**, then pick up the hydrants at the City of Phoenix Water Stores, **2500** South 22nd Avenue.

Whereas a new fire hydrant furnished by the City of Phoenix is found to be defective, the Contractor shall remove the defective hydrant, return it to the **water stores**, pick up a new one and install as indicated on the plans. The second installation will be treated as a new fire hydrant installation and the Contractor will be paid for both installations, each at the unit bid price in the proposal for fire hydrant installations.

	All connections from the main to the fire hydrant shall be cast iron or ductile iron pipe as shown on the detail drawings. Fire hydrants shall be the dry-barrel type. If plugs are present in the weep holes, they shall be removed before installation. Extenders for hydrants or valves are not permitted on new fire hydrant installations unless approved by the Water Services Department.

610.5 SEPARATION:

Municipality	Supplements
TE:	SECTION 610.5 All waterlines shall be protected from corrosion by encasement in a polyethylene protective wrapping referred to hereafter as polywrap

610.5.1 General:

Water lines and sewer lines shall be separated to protect water lines from contamination by sewer lines.

The angle of a water line and sewer line crossing shall be limited to between (45) forty-five degrees and (90) ninety degrees. Intersection angles of less than (45) forty-five degrees shall not be allowed.

Separation distances are measured from the outside diameter of the water or sewer line, or the centerline of a manhole.

When water and sewer lines can not meet separation requirements, extra protection is required as described in 610.5.5 and shown in Standard Detail 404.

Extra protection requirements for line crossings are measured from the closest outside surfaces of the sewer and water line.

Water line service connections to individual building supply and distribution plumbing shall not be placed below sewer lines, and shall otherwise comply with the separation requirements of the applicable plumbing code as applied by the Agency (Administrative Authority). Methods described for extra protection do not apply to these service lines.

Water and sewer lines shall not be constructed parallel within a common trench.

Municipality	Supplements
SC:	**610.5.1 General:** At a minimum, corrosion protection shall be provided using appropriately color-coded polyethylene protection wrap per AWWA C105 on all ductile iron pipe. Color code shall be as follows: purple for non-potable water, green for sewer, and blue for potable water.

610.5.2 Water Line Separation from Gravity Sewer Lines:

Water lines shall not be placed within two (2) feet horizontal and one (1) foot vertical above and two (2) feet vertical below gravity sewer lines.

Extra protection is required where a water line is placed within six (6) feet horizontal and two (2) feet vertical above a gravity sewer line.

Extra protection is required where a water line is placed within six (6) feet horizontal and any distance below a gravity sewer line.

610.5.3 Water Line Separation from Pressurized Sewer Lines:

Water lines shall not be placed within six (6) feet horizontal and within two (2) feet vertical below or within two (2) vertical above a pressurized sewer line.

Extra protection is required where a water line is placed within six (6) feet horizontal and within six (6) feet vertical above a pressurized sewer line.

Extra protection is required where a water line is placed within (6) feet horizontal and any distance below a pressurized sewer line.

610.5.4 Water Line Separation from Manholes:

Water lines shall not pass through or come into contact with any part of a sewer manhole and shall be separated six (6) feet horizontal from the center of a sewer manhole.

610.5.5 Extra Protection:

New water lines that require extra protection from new sewer lines, shall have extra protection provided by using ductile iron pipe for both lines. Lines of standard pipe length shall be centered at the point of crossing so that no joints exist within six (feet) horizontal and only restrained or mechanical joints exist within ten (10) feet horizontal.

New water lines that require extra protection from sewer lines, shall have identification wrap and/or tape installed on the water and sewer lines for the length that requires extra protection for each line.

New water lines that require extra protection from existing sewer lines shall be constructed using the extra protection specified for new water lines, and the existing sewer line:

(1) shall be reconstructed using a standard length of ductile iron pipe centered at the point of crossing so that no joints exist within six (feet) horizontal and only restrained or mechanical joints exist within ten (10) feet horizontal, or

(2) shall be encased in 6 inches of concrete for the horizontal distance of the line that requires extra protection but for a distance no less than ten (10) feet horizontal.

Existing water lines that require extra protection from new sewer lines shall provide for extra protection by:

(1) constructing the new sewer line and reconstructing the existing water line using ductile iron pipe for both lines with standard pipe lengths centered at the point of crossing so that no joints exist within six (feet) horizontal and restrained or mechanical joints exist within ten (10) feet horizontal, or

(2) encasement of both the existing water line and the new sewer line in six (6) inches of concrete for the horizontal distance of the lines that require extra protection but for a distance no less than ten (10) feet horizontal.

(3) Extra protection for existing ductile iron water lines can be met by the installation of restrained or mechanical joints on the existing water line within (10) feet horizontal of the crossing and either

(a) construction of new sewer line using a standard pipe length of ductile iron pipe centered at the point of crossing so that no joints exist within six (feet) horizontal and restrained or mechanical joints exist within ten (10) feet horizontal, or

(b) encasement of the new sewer line in 6 inches of concrete for the horizontal distance of the line that requires extra protection but for a distance no less than ten (10) feet horizontal.

610.5 POLYETHYLENE CORROSION PROTECTION:

Municipality	Supplements
SC:	**610.6 VALVES:** Water line air release and vacuum valves (blow-off valves) shall not be constructed in driveways, sidewalks, washes or retention/detention areas unless approved by the City. All valves shall be installed with appropriate sized debris caps. The handle color shall be blue for potable and purple for non-potable to indicate type of line. Acceptable manufacturer is SW Services in Phoenix, or approved equal

610.6.1 General: Where called for in the plans and specifications or directed by the Engineer, pipe, valves and fittings shall be protected from corrosion by encasement in a polyethylene protective wrapping referred to hereafter as polywrap. Although not intended to be a completely air and water tight enclosure the polywrap shall provide a continuous barrier between the pipe and surrounding bedding and backfill.

610.6.2 Materials: The polywrap shall be of virgin polyethylene, not less than 8 mils in thickness, formed into tubes or sheets as may be required. Naturally pigmented material may be used where exposure to ultra violet light will be less than 48 hours. Otherwise the material shall be pigmented with 2 to 2 1/2 percent of well dispersed carbon black with stabilizers.

The polywrap shall be secured as specified below with 2 inches wide pressure sensitive plastic tape not less than 10 mils thick. Tape shall be Scotchrap No. 50, Polyken No. 900, Tapecoat CT, Johns-Manville No. V-10 Trantex, or approved equal.

The minimum tube size for each pipe diameter shall be per Table 610-1.

TABLE 610-1

POLYWRAP FLAT TUBE WIDTHS

Nominal Pipe Diameter (Inches)	Cast Iron Or Ductile Iron With Push-On Joints (inches)	Cast Iron Or Ductile Iron With Mechanical Joints (inches)
4	14	16
6	17	20
8	21	24
10	25	27
12	29	30
14	33	34
16	37	37
18	41	41
20	45	45
24	53	53

610.6.3 Installation: The polyethylene tubing shall be cut into lengths approximately 2 feet longer than the pipe sections. With the pipe suspended from the center the tube shall be slipped over the spigot end and bunched up between the point of support and the spigot end. After the pipe is installed into the bell of the adjacent pipe the pipe shall be lowered to the trench bottom and the supporting sling removed from the center of the pipe. The pipe shall then be raised at the bell end enough to allow the tube to be slipped along the full length of the barrel with enough left at each end to overlap the adjoining pipe about 1 foot. A shallow bell hole must be made at each joint to facilitate installation of the polywrap.

Pull the bunched-up polywrap from the preceding length of pipe, slip it over the end of the new length of pipe, and secure in place with one circumferential turn of tape plus enough overlap to assure firm adhesion. Then slip the end of the polywrap from the new pipe section over the end of the first wrap until it overlaps the joint at the end of the preceding length of pipe. Tape it in place.

The loose wrapping on the barrel of the pipe shall be pulled snugly around the barrel of the pipe, and excess material folded over the top of the pipe and the folds held in place by means of short strips of adhesive tape, at about 3 foot intervals along the pipe.

Repair any rips, punctures or other damage to the tube with the adhesive tape or pieces of tube material secured with tape.

Bends and reducers in the line shall be covered with polyethylene in the same manner as pipe.

Valves, tees, crosses and outlets shall be wrapped with flat sheets of the same material. The sheets shall be passed under valves and brought up around the body to the stem. Edges shall be brought together, folded twice and secured with the adhesive tape.

610.6.4 Payment: Payment for this item shall be per the provisions of Subsections 109.4 and 109.5 of the specifications unless this item is specifically called for on the plans or in the supplemental specifications or special provisions as a specific component and pay item for a given project.

610.7 VALVES:

Valves shall be installed in accordance with AWWA C-600 or AWWA C-603 modified as follows:

All tapping sleeves, gate valves, butterfly valves, air release and vacuum valves and corporation stops shall be in accordance with Section 630.

Just before installation in the trench, valves shall be fully opened and closed to check the action, and a record made of the number of turns required to fully open or close the valve. For valves 16 inches and larger, a member of the water utility shall be present to check the action and record the number of turns. The inside of all valves shall then be thoroughly cleaned and the valve installed.

Valves 12 inches and smaller in size shall be supported by concrete blocks, in accordance with the standard details.

Valves 16 inches and larger in size along with their bypass valves, shall be supported on concrete slabs, and/or concrete piers, as indicated on the plans.

Concrete supports shall be provided under valves in vaults and manholes, and shall be constructed an inch low, then grouted with non-shrink grout. Adjustable pipe supports shall be as indicated on the plans. Buried valves shall be supported on concrete blocks as detailed on the plans.

Valve boxes shall be installed over all buried valves in accordance with standard details.

Standard couplings or matching joints shall be used when more than one length of pipe is required, or when two or more pieces are joined, to form the valve box riser. Install extension stems on all valves where the operating nut is 5 feet or more below grade.

Municipality	Supplements
CH:	**SPECIFICATION NO. 10** **STANDARDS FOR** **WATER PIPE AND FITTINGS** **4" THROUGH 16" DIAMETER** C. **610.6 VALVES** Valves shall be installed in accordance with AWWA C-600 or AWWA Manual 23, modified as follows.

610.8 MANHOLES AND VAULTS:

Construction shall consist of furnishing all materials and constructing manholes or vaults complete in place, as detailed, including foundation walls, cast iron steps, frames, covers, and any incidentals thereto, at location shown on the plans.

Manholes shall be constructed to conform with the requirements of Section 625 and standard details, except the inside diameter shall be 60 inches.

Vaults shall be constructed of reinforced concrete conforming to Section 725 and of concrete pipe conforming to ASTM C-76 Wall A or B. Vaults shall be kept moist for 7 days before backfilling.

Municipality	Supplements
SC:	**MANHOLES AND VAULTS:** Construction shall consist of furnishing all materials and constructing manholes or vaults complete and in place, as detailed, including foundation walls, access steps, frames, covers, and any incidentals thereto, at the location shown on the plans. Vaults shall be constructed of reinforced concrete conforming to MAG Section 725 and of concrete pipe

	conforming to ASTM C-76, Wall A or B. Vaults shall be kept moist 7 days before backfilling. Manholes shall be constructed to conform to the requirements of MAG Section 825, as supplemented by COS Section 625, and the COS Standard Details, except as modified below. Water manhole frames shall be "Pamrex" as manufactured by Saint-Gobain or an approved equal. Frames and covers shall be manufactured from ductile iron and be capable of withstanding a test load of 80.000 pounds. Covers shall be hinged and incorporate a 90 degree blocking system to prevent accidental closure, be one man operable using standard tools, and come equipped with a locking mechanism. Frames shall be circular, incorporate a sealing ring, and be available in a 24-inch or 32-inch opening as specified on the plans. The flange shall incorporate bedding slots and bolt holes. All components shall be black coated. The cover shall be stamped "Water".

610.9 FIRE HYDRANTS:

The Contractor shall furnish all labor, materials, and equipment necessary to install fire hydrants complete in place at locations shown on the plans in accordance with the standard details and special provisions. Fire hydrants furnished by the Contractor shall conform to the requirements of Section 756.

If paint is chipped, scuffed, or otherwise damaged during handling and installation, the Contractor shall touch up such spots as may be designated by the Engineer.

All hydrants must be flushed and left in good working condition with the control valve open.

Municipality	Supplements
SC:	**610.9 FIRE HYDRANTS:** *:* Fire hydrants shall not be constructed in driveways, sidewalks, washes, or retention/detention areas unless approved by the City. Minimum distance allowable between the centerline of the lowest nozzle and ground line is 18 inches. Installation shall be in accordance with MAG Standard Detail 360 and testing shall be according to AWWA. Standards. The hydrant shall be suitable for installation in a 42-inch depth of trench (3.5 foot bury hydrant). The use of Gradelok connector pipe as manufactured by Assured Flow Sales, Inc. or approved equal shall be required when main depths exceed 42 inches. Not more than one 6-inch fire hydrant extension shall be installed for any hydrant. Should the ground line adjacent to an existing fire hydrant change due to landscaping and/or construction, the Contractor shall be responsible for adjusting the hydrant to meet the specifications outlined in MAG Standard Detail 360. Adjustments shall not exceed one 6-inch extension on an existing hydrant. For adjustments in excess of 6 inches, the use of Gradelok connector pipe or approved equal shall be required. In applications of excessive depth, vertical entry hydrants approved by Water Operations are acceptable.

Municipality	Supplements
TE:	**<u>SECTION 610.9</u>** Add the following to the last paragraph: Contractor shall cover all hydrants installed with burlap or similar cover until hydrants are put into use.

610.10 CONNECTION TO EXISTING MAINS:

Existing pipe to which connections are to be made shall be exposed by the Contractor as directed by the Engineer, to permit field changes in line, grade or fittings, if necessary.

All connections to existing mains shall be constructed according to the plans.

Valves connecting new work to the existing system shall be kept closed at all times.

Only Agency personnel shall operate existing valves. The Contractor shall not operate valves in the existing system.

After disinfected samples have been taken and the new work passes the bacteriological tests, the new line shall then be turned over to the Contracting Agency with all branch lines and tie-in valves closed.

When shutdown of an existing water main is necessary in order to connect to the new lines, the Contractor shall make application and pay the required charges to the Contracting Agency. A conference between the Contractor's representative, Engineering Inspection, and Water Distribution personnel shall establish the time and procedures to insure that the shutdown will be for the shortest possible time. If necessary to minimize inconvenience to customers, shutdowns may be scheduled during other than normal working hours. The water supply to some customers, such as hospitals, cannot be shut off at any time. Provisions to furnish a continuous supply of water to such establishments will be required. After the procedures and time for a shutdown are agreed upon, it shall be the Contractor's responsibility to notify all customers in advance that the water will be turned off. When possible, customers shall be notified 24 hours in advance and in no case, except in emergency, shall notification be less than 30 minutes. Notification shall be in writing, giving the reason for the shutdown and the time and duration the water service will be shut off.

The Contracting Agency will close existing valves, but will not guarantee a bone-dry shutdown.

Municipality	Supplements
SC:	**610.10 CONNECTION TO EXISTING MAINS:** COS Inspection Services (telephone (480)312-5750) shall be contacted 48 hours prior to all water system shutdowns. The Contractor shall have all materials and equipment necessary to do the work at the jobsite prior to the shutdown occurring. The Contractor shall be responsible for providing a written notice of the proposed shutdown to all affected water customers a minimum of 24 hours in advance except in an emergency. Ties into existing PVC water mains shall be accomplished by installing a stainless steel tapping sleeve and valve. Cast iron tees may be used with City approval. All valve boxes shall be adjustable cast iron with pentagonally-bolted lids per MAG Standard Detail No. 391-1-C and COS Standard Detail 2270 unless specified otherwise on the plans. Stainless steel tapping sleeves shall be 360 degree, full circle tapping sleeves and shall conform to COS Supplemental Specification Section 630.

610.11 METER SERVICE CONNECTIONS:
All new meters must be installed by the Contracting Agency after the proper application as required by Code with fees paid at prevailing rates.

When plans call for connections from a new water main to an existing water meter, the work shall include new copper pipe and fittings except as follows:

(A) Wrapped galvanized pipe shall be used to connect or extend existing galvanized service pipe. Type K soft copper pipe or tubing shall be used to connect or extend existing copper service pipe except when otherwise called for in the plans.

(B) When the existing main is not abandoned, and the existing meter is to be connected to the new line, the corporation stop at the old main shall be closed and the abandoned service line cut 6 inches from the old main.

(C) Taps and service connections to the new main shall be made prior to testing and disinfection of the new line.

(D) Meter service piping may be installed by drilling in place of open cut construction when approved by the Engineer.

When called for on the plans, the meter and box shall be relocated by the Contractor as directed by the Engineer. Existing meters which are shown on the plans to be relocated shall be located and installed in accordance with standard details.

Water meter boxes which are broken during construction shall be replaced by the Contractor at no additional cost to the Contracting Agency. Existing meter boxes which are already broken prior to start of construction shall be replaced by the Contractor with boxes furnished by the Contracting Agency. Boxes may be picked up by the Contractor after written authorization is received from the Engineer. The written authorization shall include the street address of each broken meter box and the size of meter box required. All water meter boxes shall conform to the standard details.

Municipality	Supplements
CH:	**SPECIFICATION NO. 10** **STANDARDS FOR** **WATER PIPE AND FITTINGS** **4" THROUGH 16" DIAMETER** D. **610.10 METER SERVICE CONNECTIONS** (E) Service taps shall be installed using an all bronze double-strap tapping saddle or a tapped tee. Any tapping saddle for use on PVC pipe shall provide full support around the circumference of the pipe and a bearing area for 2 inches minimum along the axis of the pipe.

Municipality	Supplements
SC:	**610.11 METER SERVICE CONNECTIONS:** Water meters shall not be constructed in driveways sidewalks, washes or retention/detention areas unless approved by the City. All water service lines constructed under existing pavement shall be installed by mechanical/pneumatic underground boring unless otherwise approved by the COS Transportation Maintenance Director. Water boring is not allowed for construction of water service lines under existing pavement. Polyethylene and polybutylene material shall not be used in any water system installation. Pack joint meter stops and corp stops shall be used exclusively.

610.12 FIRE LINE SERVICE CONNECTIONS:

Fire line service connections shall be installed in accordance with standard details.
The fire line from the control valves at the main to the detector check valve shall be constructed of cast iron or ductile iron pipe to Section 750.

610.13 COUPLINGS, JOINTS, GASKETS AND FLANGES:

(A) Couplings: The couplings used to join the pipe to flanged valve adapters shall be Dresser Style 38, Smith-Blair 411 or an approved equal.

(B) Joints: The joints and fitting shall conform to Sections 750 and 752.

(C) Bolts and Nuts:

(1) For pipe 12 inches and smaller: Bolts and nuts for use in field connections or for connecting fittings shall be carbon steel equivalent to ASTM A-307, Grade B, with cadmium plating in accordance with ASTM B-766, except that the minimum thickness of the plating shall be .00020 inches. Cadmium plated bolts shall have Class 2A threads and the nuts used with them shall have Class 2B threads. All bolt diameters shall normally be 1/8 inch smaller than the bolt hole diameter. High strength, heat treated cast iron tee-head bolts with hexagon nuts, all in accordance with the strength requirements of AWWA C-111, may be used in lieu of the cadmium plated bolts and nuts for jointing mechanical joint cast iron or ductile iron pipe and fittings only.

(2) For pipe 16 inches and larger: All bolts and nuts on flanges for valves and flexible couplings shall be carbon steel equivalent to ASTM A-307, Grade B. Bolt diameters shall normally be 1/8 inch smaller than the bolt hole diameters.

These bolted joints shall be protected as follows: Following installation and before backfilling, all couplings, steel flanges, bolts, nuts, anchor bolts and rods, bolting of all flanged valves, and all exposed steel shall be protected from corrosion by either of the two methods outlined below at the Contractor's option.

(A) Below ground installations shall be coated with NO-OX-ID “A” with a film of not less than 1/32 inch thick and then coated with cement mortar not less than 1 inch thickness before backfilling. Cement mortar shall be composed of 1 part cement, ASTM C-150, Type II, low alkali, to 3 parts sand. Before application of the cement mortar coating the area to be protected shall be covered with a layer of 2 x 2 inch No. 14 gage welded wire fabric, firmly wired in place.

(B) Below ground installations shall be protected by the application of hot coal-tar enamel. The coal-tar enamel shall be in accordance with AWWA C-203 and shall be applied to the top part of the pipe or fittings by daubers for at least 2 coats for a total minimum thickness of 1/16 inch. The coal-tar for under side of the pipe flanges or fittings shall be applied by the pan or cocoon method as described below and in AWWA Manual M-11, Steel Pipe.

Pan Method: The coating pan is securely anchored in place on the underside of the pipe and straddling the connection to be coated. The pan shall be wide enough so that the entire connection will be coated.

Hot coal-tar enamel is poured into the pan, from one side only, until the pan is completely filled. The drain plug or valve, is then opened and the excess coal-tar drained out. The pan can then be removed. Details of the coating pan and corresponding dimensions are given in AWWA Manual M-11.

The upper portion of the connection, and all remaining exposed steel pipe, will then be coated by the use of a dauber. The coal-tar coating shall be applied in at least 2 coats for a minimum thickness of 1/16 inch. The daubers and method of application conform to AWWA C-203. No thinning will be allowed.

Cocoon Method: The cocoon is formed by placing glass fiber cloth or roofing paper, of the proper width, around the underside of the connection and adjacent exposed steel pipe. The edges of the cocoon shall be securely fastened to the pipe. Backfill is lightly placed to the spring line, and the top of the cocoon is opened and layed back on the filled area and hot coal-tar enamel poured, from one side only, until the cocoon is completely filled. The loose backfill prevents rupture of the cocoon. The upper portion of the connection and remaining exposed steel pipe shall be coated as above.

(D) Gaskets: Except as otherwise provided, all gaskets for pipe lines shall be one piece full faced gaskets from one-ply cloth inserted SBR rubber material. Gaskets for flanges 20 inches and smaller shall be from 1/16 inch thick material. Gaskets for flanges 24 inches and larger shall be from 1/8 inch thick material. Gasket material shall be J-M 109 as manufactured by Johns-Manville Corporation or an approved equal. Physical characteristics of the rubber compound shall meet ASTM D-2000, Class 4AA805A13.

(E) Flanges: Cast iron flanges shall conform to AWWA C-110 as to material, diameter, thickness, drilling, etc. Steel flanges shall be ring or hub type, and shall conform to AWWA C-207, Class D. All flanges shall be drilled and have flange diameters and bolt circles conforming to AWWA C-110, except bolt holes will be 1/8 inch larger than the bolts given for the various sizes. All bolts shall be as specified above and all flanges shall have a flat facing.

610.14 BLOCKING:

All pipe lines, valves and fittings 16 inches and smaller in diameter shall be blocked with concrete thrust blocks in accordance with standard details. Thrust block areas for pipe, valves and fittings larger than 16 inches in diameter shall be calculated for each size pipe, valve and fitting to be installed and shown on the plans.

Thrust block areas shall be calculated on the basis of 200 psi test pressure bearing against undisturbed 3,000 psf soil.

If soil or pressure conditions other than those stated above are encountered, the thrust block areas shall be calculated and submitted for approval. The areas stipulated in the standard details are minimum and shall not be decreased.

When restrained/welded joints are specified to resist thrust forces, blocking is not required.

With the Engineers approval, restrained/welded joints may be used in lieu of thrust blocks to resist thrust forces.

Municipality	**Supplements**
CH:	**SPECIFICATION NO. 10** **STANDARDS FOR** **WATER PIPE AND FITTINGS** **4" THROUGH 16" DIAMETER** 8. **<u>THRUST BLOCKS:</u>** Thrust blocks shall be installed per MAG 610.13.

Municipality	**Supplements**
PH:	MAG Section 610.14 TESTING: is deleted in its entirety and the following is substituted: **Section 610.14 TESTING:** The Contractor shall test waterlines for water tightness, including all fittings and connections to the waterlines. Each pipe shall be tested for leakage and pressure in accordance with applicable pro-visions of AWWA standards and/or Manuals, except as modified below. The Contractor shall provide all vents, piping, plugs, bulkheads, valves, bracing, blocking, pump, including measuring device and all other equipment necessary for making the tests, except pressure gages. The pipe shall be tested between each valve or between a valve and the closed end of the pipe. Pipe test section shall be limited to 1/2 linear mile, or less, unless otherwise approved in writing by the Engineer. If mechanical compaction is used in the backfilling operations, the test shall be made after the backfilling is completed or compacted. All connections, blowoffs, hydrants and valves shall be tested with the main, where practical. The test section shall be slowly filled with potable water and all air shall be vented from the line. The rate of filling shall be as approved by the Superintendent of Water Distribution, with at least 24-hour notice required before filling is scheduled. (A) Pressure Tests: Waterlines, including all fitting and connections shall be tested for water tightness by subjecting each test section to pressure test. The test pressure shall be measured at the lowest end of the test section. The test pressure shall be 188 psi unless otherwise specified. The duration of each pressure test shall be at least 2 hours. The pressure test shall begin after the pipe has been filled with water for at least 24 hours to allow for absorption. (B) Leakage Tests: Leakage tests shall be made after pressure test has been completed, pressure test results are satisfactory, and all backfilling and compaction is completed. The duration of each leakage test shall be at least 2 hours. Leakage test pressure shall be at least 150 psi and

not vary more than 5 psi during the test.

The maximum allowable leakage from the pipe line shall be determined by the applicable formula:

$$L = \frac{NDSP}{4500}$$ (Pipe Larger than 16")

$$L = \frac{NDSP}{7400}$$ (Pipe 16" and smaller)

in which:

L = allowable leakage in gallons per hour

N = number of joints in the pipe being tested, with no allowance for joints at

D = nominal inside diameter of pipe in inches.

P = average test pressure, in psi gage, as measured at the lowest point in the

Should the test on any section of the pipeline show leakage greater than specified above, the Contractor shall locate and correct until the leakage is within the specified allowance for a 2-hour duration. All repairs and retests shall be at the Contractor's expense.

Leakage is defined as the quantity of make-up water necessary for the test section to maintain the specified leakage test pressure after the pipeline has been filled with water and all air expelled.

Connections to existing pipelines or existing valves shall be made after new construction has satisfactorily passed both the pressure and leakage tests.

610.15 TESTING:

Water lines, including all fittings and connections to the water mains shall be tested for watertightness by subjecting each section to hydrostatic tests in accordance with applicable provisions or AWWA C-600, except as modified below, and shall consist of pressure test and leakage tests. The Contractor shall provide all vents, piping, plugs, bulkheads, valves, bracing, blocking, pump, including measuring device and all other equipment necessary for making the tests, except pressure gages, and shall pay the Contracting Agency for water used in the tests.

(A) Pressure Tests: Water lines, including all fittings and connections to the water mains shall be tested for watertightness by subjecting each section to pressure test, measured at the lowest end of the section under test. The test pressure shall be at least 200 psi for lines smaller than 16 inches and 150 psi for lines 16 inches or larger unless otherwise noted. The duration of each pressure test shall be at least 2 hours. Each section of a new line between sectionalizing valves or between the last sectionalizing valve and the end of the project shall be tested separately as required in AWWA C-600, and/or as modified in these specifications, except that any such section less than 500 feet in length may be tested with the adjacent section, if both sections of line have the same pipe class rating. No section greater than 1/2 mile in total pipe length shall be tested without special written permission of the Engineer.

The test may be made before or after backfilling. However, if mechanical compaction is to be used in the backfilling operations as spelled out in AWWA C-600, the test shall not be made until the backfilling is completed and compacted. All connections, blowoffs, hydrants and valves shall be tested with the main as far as is practicable.

The test section shall be slowly filled with potable water and all air shall be vented from the line. The rate of filling shall be as determined by the Superintendent of Water Distribution, with at least 24 hour notice required before tests are scheduled. While the test section is under test pressure, a visual inspection for leaks may be made along the pipe line, and all visible leaks repaired. The pressure test shall not begin until the pipe has been filled with water for at least 24 hours to allow for absorption.

(B) Leakage Tests: Leakage tests shall be made after pressure test has been satisfactorily completed and all backfilling and compaction is completed to top of trench. The Contractor shall furnish the necessary apparatus and assistance to conduct the test.

The duration of each leakage test shall be at least 2 hours. To pass the leakage test, the leakage from the pipe line shall not exceed the leakage allowed by the following formula:

Municipality	Supplements
SC:	**610.15 TESTING:** All ductile iron pipe and concrete cylinder pipe installations shall be corrosion protected. Final acceptance of the work shall not be given until entire system continuity/protection is shown to exist and is accepted by the COS Water Resources Department. *Change the second sentence of Paragraph (A) to the following (new text is highlighted in bold italics):* (A) Pressure Tests: Water lines, including all fittings and connections to the water mains shall be tested for watertightness by subjecting each section to pressure test, measured at the lowest end of the section under test. ***The test pressure shall be at least 125% of the design pressure, or 200 psi, whichever is greater.***

Municipality	Supplements
SC: has added the following	**610.15.1ectrolysis Test Stations:** The Contractor shall furnish all materials and perform all work for installing a corrosion monitoring system for all buried concrete cylinder pipelines. (A) Materials and Construction Methods: Four-wire insulating test stations shall be installed at all insulating fittings where shown on the plans, with two wires installed on each side of the insulating fittings. Wires for corrosion monitoring points shall be minimum AWG No. 8 insulated with HMW/PE insulation. Wires shall be sized such that they may be used for any and all of the field tests specified. Thermite weld connections, as shown, specified or directed by the Engineer, shall be made with thermite weld kits specifically designed by the manufacturer for such applications. Thermite welds shall be a maximum 15-gram charge. As an option to thermite weld connections, E70XX electrode welds may be used. The E70XX electrode weld shall be installed in accordance with the pipe manufacturer's instructions. When connecting test lead conductors by the use of thermite weld equipment to concrete cylinder pipe or steel pipe, the pipe surface shall be cleaned by scraping, filing, or wire brushing to produce a clean, bright surface. The thermite weld shall be installed in accordance with the manufacturer's instructions and as indicated. Upon completion of the thermite weld, but before the application of the cement-mortar coating, the Contractor shall strike the weld with two sharp blows from a brass hammer. All defective welds shall be replaced by the Contractor. Valve boxes shall be Brooks 1-RT, or equal, with cast iron cover marked "C.P. Test" and shall be provided with pentagonally bolted lids. (B) Field Tests: (1) Field tests shall be performed by the Contractor as required to determine the following: - Pipeline electrical conductivity. - Effectiveness of insulating joints. - Metering point integrity. - Presence of stray D/C current on the pipeline. - Initial pipe-to-soil potential.

	All test data shall be submitted for approval. (2) The buried pipelines shall be tested for electrical continuity and dielectric isolation from other structures and pipelines after all connections have been made. The testing procedure shall be as follows: (a) The test shall be conducted by measuring response of the pipe to the application of cathodic protection test current with an auxiliary ground at a minimum of 10 feet from the pipeline. The positive terminal of the portable test rectifier unit shall be connected to the auxiliary ground. The negative terminal shall be connected to the pipeline at a test station. the test rectifier shall be energized with A/C power and shall be adjusted to provide sufficient D/C current to obtain adequate pipe-to-soil potential shifts along the pipeline for performing the tests. A current interrupter shall be inserted in the test rectifier circuit so that the rectifier is turned "OFF" and "ON" automatically. A set of "NATIVE" potentials shall be obtained prior to the application of the test current. (b) Measurements of the pipe-to-soil potential shall be made with the test current turned both off and on. The pipe-to-soil potential shall be measured at representative locations along the full lengths of the pipeline to be tested. In addition, potential measurements shall be taken across the dielectric insulating fittings. The pipe-to-soil potentials shall be measured with a potentiometer/voltmeter circuit of a multi-combination meter and with respect to portable copper sulfate reference electrode placed at grade. Contact to the pipe for obtaining potential measurements shall be made at test stations previously installed during construction for that purpose. (c) If the pipe-to-soil potential is made more positive by application of the test current, electrical discontinuity of the pipeline is indicated between that point and the point at which the test rectifier negative connection was made. (d) If the pipe-to-soil potential is made more negative by application of the test current, electrical continuity of the pipeline is indicated between that point and the point at which the test rectifier negative connection was made. The magnitude of negative shifts will be analyzed to determine if the degree of electrical continuity is consistent with the specified requirements for joint bonding. (e) Dielectric isolation across insulating fittings shall be indicated by the pipe-to-soil being more positive or insignificant differences in the pipe-to-soil potentials across the fittings with the application of the test current. (f) Multiple test set-ups will be necessary so that the full length of the pipeline is demonstrated to be electrically continuous and dielectrically isolated from other structures.

$$L = \frac{ND\sqrt{P}}{4500}$$

in which

L = allowable leakage in gallon per hour.

N = number of joints in the pipe line being tested, this "N" being the standard length of pipe furnished divided into the length being tested, with no allowance for joints at branches, blowoff, fittings, etc.

D = nominal diameter of pipe in inches.

P = average observed test pressure of the pipe being tested, equal to at least 100 percent of the class rating of pipe being tested, in psi gage, based on the elevation of the lowest point in the line or section under test and corrected to the elevation of the test gage.

Should the test on any section of the pipe line show leakage greater than specified above, the Contractor shall locate and repair the defective pipe, fittings, or joint until the leakage is within the specified allowance of 2 hour duration.

Leakage is defined as the quantity of water necessary to be supplied into the pipe line section under test to maintain the specified leakage test pressure after the pipe line has been filled with water and all air expelled. All repairs and retests, if required, shall be made at the Contractor's expense.

Connections to the existing pipelines or existing valves shall not be made until after that section of new construction has satisfactorily passed the hydrostatic tests.

Cast iron and Ductile pipe used in conjunction with ACP will be tested to the ACP standards, unless otherwise directed by the Engineer. High pressure systems of all cast iron or Ductile iron will be tested in accordance with AWWA C-600, Section 4.1.

Backfill and compaction for the full distance encompassed by restrained\welded joints shall be completed prior to testing.

Municipality	**Supplements**
CH:	**SPECIFICATION NO. 10** **STANDARDS FOR** **WATER PIPE AND FITTINGS** **4" THROUGH 16" DIAMETER** E. **610.14 TESTING** The Contractor shall test water lines for water tightness, including all fittings and connections to the water lines. Each pipe shall be tested for leakage and pressure in accordance with applicable provisions of AWWA standards and/or Manuals, except as modified below. The Contractor shall provide all vents, piping, plugs, bulkheads, valves, bracing, blocking, pump, including measuring devices and all other equipment necessary for making the tests, except pressure gauges. The pipe shall be tested between each valve or between a valve and the closed end of the pipe. Pipe test sections shall be limited to ½ linear mile or less, unless otherwise approved in writing by the Engineer. All connections, blow-offs, hydrants and valves shall be tested with the main, where practical.

The test section shall be slowly filled with potable water and all air shall be vented from the line. The rate of filling shall be as approved by the Off-site Inspector, with at least 24 hour notice required before filling is scheduled.

(A) Pressure Tests: Water lines, including all fittings and connections, shall be tested for water tightness by subjecting each test section to a pressure test. The test pressure shall be measured at the lowest end of the test section. The test pressure shall be 188 psi unless otherwise specified. The furation of each pressure test shall be at least 2 hours.

The pressure test shall begin after the pipe has been filled with water for at least 24 hours to allow for absorption.

(B) Leakage Tests: Leakage tests shall be made after the pressure test has been completed, pressure test results are satisfactory, and all backfilling and compaction is completed.

The duration of each leakage test shall be at least 2 hours. Leakage test pressure shall be at least 150 psi and not vary more than 5 psi during the test.

The maximum allowable leakage from the pipe line shall be determined by the applicable formula:

$$L = ND\frac{\sqrt{P}}{7400}$$

in which:

L = allowable leakage in gallons per hour

N = number of joints in the pipe line being tested, with no allowance for joints at branches, blow-offs, fittings, and similar appurtenances. “N” is calculated using the standard length of pipe installed divided into the length being tested.

D = nominal inside diameter of pipe in inches

P = average test pressure, in psi gage, as measured at the lowest point in the test section.

Should the test on any section of the pipe line show leakage greater than that specified above, the Contractor shall locate and correct the deficiency and retest until the leakage is within the specified allowance for a 2 hour duration. All repairs and retests shall be the contractor’s responsibility and expense.

Leakage is defined as the quantity of make-up water necessary for the test section to maintain the specified leakage test pressure after the pipe line has been filled with water and all air expelled.

610.16 DISINFECTING WATER LINES:

After pressure testing and before placing in service, all water lines shall be disinfected. Disinfection shall be accomplished in accordance with Section 611. All valves in the lines being disinfected shall be opened and closed several times during the 24 hour period of disinfection.

610.17 PAVEMENT AND SURFACING REPLACEMENT:

Pavement and surfacing replacement shall be in accordance with the requirements of Section 336.

610.18 CLEANUP:

When testing, chlorination, compaction, and cleanup do not follow pipe laying in an orderly manner, the Engineer reserves the right to close down trenching and pipe laying until these operations are adequately advanced.

610.19 MEASUREMENT AND PAYMENT:

(A) Pipe:

(1) Measurement of all pipe shall be of the linear feet of pipe installed, measured along the centerline of the pipe, through all valves and fittings, from the centerline of the fittings or centerline of valves on ends of pipe to the centerline of fittings, centerline of valves on ends of pipe or to the end of pipe, as the case may be, for all through runs of pipe. Measurement shall be to the nearest 0.1 foot.

Measurement of branch line pipe shall start at the centerline of valve at connection to the main. Branches of tees that are valved and capped will not be measured.

Measurement of meter service pipe shall be from the centerline of the new main to the connection at the meter, along the centerline of service pipe.

(2) Payment will be made at the unit price bid per linear foot of each type and size of pipe called for in the proposal. Such payment shall be compensation in full for furnishing and installing the pipe and fittings, specials, adapters, etc., complete in place, as called for on the plans and/or on the standard details, and shall include all costs of excavation, removal of obstructions, shoring and bracing, bedding, backfilling, compaction, maintenance of traffic, testing, disinfecting, connections to existing lines or works, and all work not specifically covered in other pay items.

A contingent item for cast iron fittings not shown on the plans shall be included in the proposal. Payment will be made at the unit price bid per pound on the theoretical weight of the fittings installed, which shall be compensation in full for furnishing and installing the fittings.

(B) Service Connection To Existing Water Meters:

(1) Measurement shall be of the number of unit connections made for water meter services, as called for in the proposal. Each proposal item unit shall consist of the connection to the water main and to the meter, as required in standard details.

(2) Payment will be made at the unit price bid for each unit water meter service connection and shall be compensation in full for labor materials (other than pipe) equipment, tapping, and all necessary incidentals. Payment for new service pipe required to make the connection will be made separately, as stipulated above.

(C) Relocation of Existing Meters and Boxes: Measurement shall be of the number of meters and boxes moved and reinstalled. Payment will be made at the unit price bid in the proposal for each meter and box relocated and installed.

(D) Permanent Pipe Supports and Encasement of Existing Pipes: Measurement shall be of each unit included in the proposal, and payment shall be compensation in full for supporting or encasing existing pipe, as required on the plans, including excavation, form work, reinforcing, concrete, handling and controlling flows in the existing pipe, removing and replacing existing pipe where necessary, supporting, backfilling and compaction, and pavement and/or surfacing replacement required in excess of pay width(s) allowed in Section 336.

(E) Concrete Thrust Blocks: Concrete thrust blocks and anchors for all pipe 16 inches and larger shall be measured by the cubic yard(s) of concrete placed, as required on the plans and/or as directed by the Engineer. Payment will be made at the unit price bid per cubic yard, and shall be compensation in full for excavation, formwork, placing and finishing concrete, reinforcing, backfilling and compaction, and pavement and/or surfacing replacement required in excess of pay width(s)

allowed in Section 336. All thrust blocks and anchors for 12 inches and smaller pipe shall be included in the linear foot cost of the pipe.

(F) Valves: Measurement of and payment for valves, tapping sleeves and valves, and valve boxes shall be for each item furnished and installed, as designated in Section 630.

(G) Fire Hydrants: Measurement shall be the number of fire hydrants installed. Payment will be at the unit price bid for the installation of each fire hydrant complete in place and in operating condition. The 6 inches cast iron pipe and fittings, required for making the connection from the main to the hydrant, shall be a separate pay item in the proposal as described above.

(H) Pavement and/or Surfacing Replacement: Payment for pavement and/or surfacing replacement will be made as stipulated in Section 336, except as otherwise established in this specification. The cost of pavement and/or surface replacement required for meter service installations shall be included in the price bid for meter service pipe.

Municipality	**Supplements**
SC:	**610.18 MEASUREMENT AND PAYMENT**: (I) Measurement and payment for electrolysis test stations shall be per each test station as furnished and installed per the plans, including all excavation, backfill, wiring, field testing, valve box and cover, and all appurtenant work.

DISINFECTING WATER MAINS

611.1 CLEANING AND TREATING PIPE:

The interior of all pipe and fittings shall be kept as free as possible of all dirt and foreign material at all times, until the pipe is placed in the new line.

If in the opinion of the Engineer, the pipe contains dirt that will not be removed during the flushing operation, the interior of the pipe shall be cleaned and swabbed, as necessary, with a .005 to .010 percent chlorine solution.

611.2 LAYING PIPE:

If the Contractor or pipe-laying crew cannot install the pipe in the trench without getting earth into it, the Engineer may require that, before lowering the pipe into the trench, a heavy, tightly woven canvas bag of suitable size be placed over each end of the pipe and left there until the connection is to be made to the adjacent pipe.

At the close of each day's work, the end of the last laid section of pipe shall be plugged, capped, or otherwise tightly closed to prevent the entry of foreign material of any nature.

611.3 PREVENTING TRENCH WATER FROM ENTERING PIPE:

At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a watertight plug or other means approved by the Engineer. Joints of all pipe in the trench shall be completed before the work is stopped. If water is in the trench, the seal shall remain in place until the trench is pumped dry.

611.4 PACKING MATERIAL:

Only such packing materials as are included in the list of acceptable materials in AWWA C-600 for installation of cast iron water main, shall be used. The packing materials shall be handled in such a manner as to avoid contamination, and shall be dry when placed in the joints. All such materials shall be free of oil, tar, or greasy substances, except that treated paper packing material, jute, cement, or sulphur compound caulking will not be permitted.

611.5 FLUSHING COMPLETED PIPE LINES:

(A) Preliminary Flushing: All mains 12 inches and smaller shall be flushed, prior to chlorination, as thoroughly as possible with the water pressure and outlets available. Flushing shall be done after the pressure test has been made. It must be understood that flushing removes only the lighter solids and cannot be relied upon to remove heavy material allowed to get into the main during laying. It is difficult to flush mains over 12 inches in diameter, so in such instances the requirements above, must be rigidly adhered to.

Heavy duty, factory bushed, tapped couplings, with corporation stops shall be located at all high points in the lines to allow the air to be removed prior to testing the water lines and at disinfection points as may be required. Field taps will not be permitted.

The couplings, at high points and disinfection points, shall be left exposed during backfilling until the testing is complete. Couplings and corporation stops shall be left on the mains upon completion of water mains.

(B) Valve Damage by Foreign Material: Unless proper care and thorough inspection are practiced during the laying of water mains, small stones, pieces of concrete, particles of metal, or other foreign material may gain access to mains newly laid or repaired. If it is believed that such foreign material(s) may be in the main, all hydrants on the line shall be thoroughly flushed and carefully inspected after flushing to see that the entire valve operating mechanism of each hydrant is in good condition.

611.6 CHLORINE RESIDUAL:

Before being placed in service, all new mains and repaired portions of, or extensions to existing mains shall be chlorinated so that a chlorine residual of not less than 10 ppm remains in the water after 24 hours standing in the pipe.

611.7 METHODS OF APPLYING CHLORINE:

Any of the following methods of application of chlorine (arranged in order of preference) may be used, subject to the approval of the Engineer.

Liquid chlorine gas-water mixture.

Direct chlorine feed.

Calcium or sodium hypochlorite and water mixture.

Municipality	Supplements
SC:	**611.7 METHODS OF APPLYING CHLORINE:** Dry powdered calcium-hypochlorite compounds shall not be placed within pipelines during construction.

611.8 APPLICATION OF LIQUID CHLORINE:

A chlorine gas-water mixture shall be applied by means of a solution-feed chlorinating device or, if approved by the Engineer, the dry gas may be fed directly through proper devices for regulating the rate of flow and providing effective diffusion of the gas into the water within the pipe being treated. Chlorinating devices for feeding solutions of the chlorine gas or of the gas itself must provide means for preventing the backflow of water into the cylinder.

611.9 CHLORINE-BEARING COMPOUNDS IN WATER:

On approval of the Engineer, a mixture of water and a chlorine-bearing compound of known chlorine content may be substituted for liquid chlorine.

(A) Compounds to be Used: The chlorine-bearing compounds that may be used are: Calcium hypochlorite*, and sodium hypochlorite**.

(B) Preparation of Mixture: High-test calcium hypochlorite must be prepared as a water mixture for introduction into the water mains. The powder should first be made into a paste and then thinned to approximately a 1 percent chlorine solution (10,000 ppm). The preparation of a 1 percent chlorine solution requires the following proportions of powder to water:

Product	Amount of Compound	Quantity of Water (Gallons)
High-test calcium hypochlorite (65—70% Cl)	1 lb.	7.50
Liquid laundry bleach (5.25% Cl)	1—2 pts.	12.6

611.10 POINT OF APPLICATION:

The preferred point of application of the chlorinating agent is at the beginning of the pipe line extension or any valved section of it and through a corporation stop inserted in the top of the newly laid pipe. The water injector for delivering the chlorine-bearing water into the pipe should be supplied from a tap on the pressure side of the gate valve controlling the flow into the pipe line extension.

611.11 RATE OF APPLICATION:

Water from the existing distribution system or other source of supply shall be controlled so the rate of flow shall not exceed 500 gpm, unless approved by the Superintendent of Water Distribution, through a suitable measuring device into the newly laid pipe line during the application of chlorine. The rate of chlorine solution flow shall be in such proportion to the rate of water entering

the pipe that the chlorine dose applied to the water entering the newly laid pipe shall produce at least 10 ppm of residual chlorine after 24 hours standing in the pipe. This may be expected with an application of 50 ppm, although some conditions may require more.

_____

*Comparable to commercial products known as HTH, Perchloron, and Pittchlor.
**Known commercially as liquid laundry bleach.

On lines 12 inches in diameter or less, determination of the rate of flow of water into the line to be treated may be made by starting with the line full of water and measuring the rate of discharge at a hydrant located at the end of the pipe farthest away from the point of chlorine application.

For lines larger than 12 inches in diameter, the disinfection operation is generally started with the line empty.

Measurement of the flow of water into and out of all lines shall be made by means of a pilot gage, current type meter, or other approved device.

611.12 PREVENTING REVERSE FLOW:

Valves shall be manipulated so that the strong chlorine solution in the line being treated will not flow back into the line supplying the water. Check valves shall be used to accomplish this.

611.13 RETENTION PERIOD:

Treated water shall be retained in the pipe long enough to destroy all nonspore-forming bacteria. This period should be at least 24 hours and should produce no less than 10 ppm residual chlorine at the extreme end of the line at the end of the retention period.

NOTE: If the circumstances are such that less than a 24 hour retention period must be used, the chlorine concentration shall be increased to 100 ppm. Under these conditions, special care should be taken to avoid attack on pipes, valves, hydrants and other appurtenances.

611.14 CHLORINATING VALVES AND HYDRANTS:

In the process of chlorinating newly laid pipe, all valves or other appurtenances shall be operated while the pipeline is filled with the chlorinating agent.

611.15 FINAL FLUSHING, SAMPLING AND TESTING:

Following chlorination, all treated water in the newly laid pipeline shall be thoroughly flushed until the replacement water throughout the new pipeline can be proved, by laboratory testing, comparable in quality to the water served to the public from the existing water system. Prior to sampling for laboratory testing, the residual chlorine throughout the length of the pipeline shall be reduced to 1.0 ppm or less. Once the required residual chlorine level in the pipeline is achieved, samples shall be taken as outlined below.

The Contracting Agency or its authorized representative will collect all samples for testing of the new water mains. To initiate the sampling and testing, the Contractor will present to the Contracting Agency a written request for such work no later than 24 hours prior to the time when samples are to be taken.

Samples shall be taken from a tap and riser located and installed in such a way as to prevent outside contamination. Samples shall never be taken from an unsterilized hose or fire hydrant, because such samples will seldom meet bacteriological standards. The number of sampling locations shall be as follows: Waterlines up to but less than 150 feet in length require one sampling riser installed as near the end as possible; lines 150 feet to 300 feet in length, two sampling risers, one near each end of the line; lines 300 to 3,000 feet in length, a minimum of three sampling risers. In addition, dead ends on main lines should be represented with a sampling riser.

The number of samples taken at each sampling location shall be determined by the Contracting Agency based on one of the following methods.

(A) One sample from each sampling location which is examined and analyzed in the laboratory over a three day (72 hour) period.

(B) Two samples taken on separate days from each sampling location. Satisfactory water quality of the new main shall continue for a period of at least two days (48 hours) as demonstrated by laboratory examination of these samples.

Upon completion of laboratory testing, results of all tests shall be sent by the laboratory to the Contracting Agency. Results of laboratory analysis will be interpreted by the Contracting Agency, and reported to the Contractor. Under no circumstance shall the Contractor contact the laboratory. If there is need for test results before written reports are submitted, such information shall be obtained only from the Contracting Agency or its authorized representative.

Municipality	Supplements
SC:	**611.15 FINAL FLUSHING, SAMPLING AND TESTING:** *Delete the second paragraph and replace it with the following paragraph:* Notify the COS Inspection Services Representative (telephone (480)312-5750) when a water system is ready to have bacterial samples taken to determine whether disinfection has been adequate. The samples are collected by the COS Water and Wastewater Quality Division on Mondays and Wednesdays only.

611.16 REPETITION OF CHLORINATION PROCEDURE:

Should the initial treatment fail to result in the conditions specified above, the original chlorination procedure shall be repeated until satisfactory results are obtained.

611.17 PAYMENT:

No separate pay item shall be contained in the proposal for disinfecting water mains. This operation shall be included in the price bid for the water mains, installed complete in place, as specified in the proposal.

SEWER LINE CONSTRUCTION

615.1 DESCRIPTION:

The construction or extension of sewer lines shall conform to the applicable standard specifications and details, except as otherwise required on the plans or as modified in the special provisions.

Concrete pipe shall conform to Section 735. High density polyethylene (HDPE) pipe shall conform to Section 738. Vitrified clay pipe shall conform to Section 743. Polyvinylchloride (PVC) pipe and fittings shall conform to Section 745.

Municipality	Supplements
ME:	X. Section 615.1 – Add the following sentence to the end of the second (last) paragraph: Ductile iron pipe shall be minimum pressure class 150 unless otherwise noted and be ceramic epoxy lined as approved by the City Engineer. The specifications for the lining can be obtained from the Engineering Office.

Municipality	Supplements
SC: has added	**615.1.1 Lining for Ductile Iron Sewer Pipe:** All ductile iron sanitary sewer pipe shall have an appropriate liner installed based on the sewer application. Cement mortar and coal tar asphalt will not be accepted as an appropriate liner material. A test report verifying the following properties and a certification of the test results must be submitted and approved by Water Resources before installation. (A) A permeability rating of 0.00 when tested according to method A of ASTM E-96-66, Procedure A with a test duration of thirty (30) days. (B) The following test must be run on coupons from factory lined ductile iron pipe: (1) ASTM B-117 Salt Spray (scribed panel): Results to equal 0.0 undercutting after one year. (2) ASTM G-95 Cathodic Disbondment 1.5 volts at 77 degrees Fahrenheit: Results to equal no more than 0.5mm undercutting after thirty (30) days. (3) Immersion Testing rated using ASTM D-714-87: (a) 20% Sulfuric Acid - No effect after one year. (b) 25% Sodium Hydroxide - No effect after one year. (c) 160 Degree Fahrenheit Distilled Water - No effect after one year. (d) 120 Degree Tap Water (scribed panel) - 0.0 undercutting after one year with no effect.

615.2 TRENCHING:

Excavation of trenches shall be accomplished in accordance with Sections 601, and 603 for HDPE pipe.

The Engineer shall furnish the Contractor alignment and elevation stakes at agreed-upon intervals and offset together with cut sheets showing the difference in elevation from the top of the stakes to the flow line of the pipe.

The trench shall be dry when the fine grading of the bottom of the trench is accomplished. Before placement of pipe the fine grade shall be carefully checked by use of a string line, laser beam, or other means so that when in final position the pipe will be true to line and grade, ±0.05 feet for 8 inches through 12 inches, ±0.10 feet for 15 inches and larger.

For PVC pipe installation the width of trench as listed in Table 601-1 or as given in the contract documents may be increased to provide sufficient space for the installation of fittings or for compaction of the bedding. For HDPE pipe installation, the width of the trench will be per Subsection 603.2. The adjusted maximum width at the top of the pipe must be approved by the Engineer. The adjustment of the trench width to accomplish the above shall be done at no additional cost to the Contracting Agency.

Municipality	Supplements
SC:	**615.2 TRENCHING:** Separate inspections by the City may be required for trench bottom preparation and for haunch consolidation.

615.3 SEPARATION:

To protect water lines from contamination by sewer lines, separation and extra protection shall be in accordance with Section 610.

Sewer lines that are constructed of ductile iron pipe for extra protection shall be internally lined for sewer service.

615.4 LAYING PIPE:

Pipe shall be of the type, class, and size called for on the plans. All pipe shall be protected during handling against impact shocks and free falls. No damaged or defective pipe shall be installed in the work. Pipe shall be kept clean at all times, and as the work progresses, the interior of the pipe shall be cleared of all dirt and superfluous materials of every description.

The laying of the pipe shall be in finished trenches free from water or debris, and shall be commenced at the lowest point, with the spigot ends pointing in the direction of the flow. Each pipe shall be laid firmly and true to line and grade, in such manner as to form a close concentric joint with the adjoining pipe and to prevent sudden offsets of the flowline. Any adjustment to line and grade shall be made by scraping away or filling in under the body of the pipe, never by wedging or blocking under the pipe ends.

The alignment and grade of each length of pipe shall be checked after setting by measurement from the string line, laser beam target or other means approved by the Engineer.

At all times when work is not in progress, open ends of the pipe and fittings shall be securely closed to the satisfaction of the Engineer, so that no water, earth or other substance will enter the pipe or fittings.

HDPE and PVC pipe and fittings shall be installed in accordance with ASTM D-2321. HDPE pipe bedding shall comply with Subsection 603.4. The PVC pipe bedding shall be placed in two lifts. The first lift will be from the bottom of the trench to the spring line of the pipe. The second lift will be from the spring line to one foot above the top of pipe. Separate inspections will be required on each lift. The Contractor shall place the first lift in a manner that will insure uniform support under the haunches and proper alignment of the pipe.

615.5 FITTINGS:

All fittings shall conform to the requirements of the pipe specifications and shall be located as shown on the plans, or as directed by the Engineer, in accordance with the standard details.

615.6 JOINTING:

Municipality	Supplements
TE:	All sewer taps are to be made by machine drill tap (factory tap) and all sewer services are to be connected using a proper sewer cup fitting or approved equal

615.6.1 Rubber Gasket Joints: Prior to making pipe joints, all surfaces of the portions of the pipes to be joined shall be cleaned, dried, and prepared in accordance with the manufacturer's recommendations. The joints shall then be carefully centered and completed.

Trenches shall be kept water-free during the installation of joints and couplings.

The joint and coupling materials will be as specified in the appropriate pipe sections and shall be installed in accordance with the manufacturer's recommendations. Cement mortar joints will NOT be permitted in sanitary sewer construction.

615.6.2 Water Stops: Water stops will be required when connecting PVC or HDPE pipe to concrete structures, manholes, etc. The water stop shall comply with Section 738 and will be installed per manufacturer recommendations.

615.7 SANITARY SEWER SERVICE TAPS:

When the construction of sanitary sewer service taps are called for in the special provisions, they shall be constructed in accordance with standard details for sewer taps except for HDPE pipe.

To maintain structural integrity of the pipe, service taps for HDPE pipe shall be constructed in accordance with the manufacturer's recommendations.

When any damage occurs to the pipe ribs or walls, outside of the tap area, the Contractor shall perform repairs, as recommended by the manufacturer at no cost to the Contracting Agency. Damage to the pipe will include but not be limited to gouging, marring, and scratching forming a clear depression in the pipe.

The location of the service tap for each property shall be in the downstream _ of the lot, or as requested by the property owner. Sewer service taps shall not be covered until they have been plugged and marked in accordance with standard details and their location has been recorded by the Engineer. Electronic markers shall be placed at no greater depth than electronic locating devices can locate them (typically 2'-4').

Municipality	Supplements
CH:	**SPECIFICATION NO. 1:** **DUCTILE IRON PIPE - SANITARY SEWER LINE** All ductile iron pipe used for sanitary sewer line construction shall be minimum class 50 conforming to MAG Specification Section 750. All ductile iron pipe shall be fully lined with either of the following lining systems. 1. **LINING SYSTEM NO. 1** A. **<u>MATERIALS</u>** The material shall be a catalyzed coal tar epoxy supplied by a reputable manufacturer having a proven history in water and waste service. All materials shall be delivered to the application plant in the original unopened containers. Handling and storage shall be in accordance with manufacturer's recommendations and

adequate to prevent damage or deterioration.

The material supplier shall supply test results and certification that the delivered materials meet the manufacturer's specifications.

Any material found to be non-conforming, damaged or deteriorated shall be immediately removed from the application plant.

The manufacturer's recommendations and specifications for this material shall be furnished to the City Engineer by the contractor.

B. **APPLICATION**

All interior barrel and joint surfaces which will be exposed to the sewer liquids and gases shall be prepared for lining so as to remove all loose foreign materials which would adversely affect the bond of the compound to the pipe surface. Since some oxides present after the manufacture of the ductile iron pipe are tightly adhering to the surface and thus become an integral part of the surface, the intent of this specification is that these tightly adhering oxides be left on the surface and only loose oxides be sand blasted away. Specifically, surface preparation shall consist of sand blasting to the extent that the entire surface is struck by the blast media. All prepared surfaces shall receive at least one coat of the specified protective compound prior to any deterioration of the prepared surface.

The lining compound shall be applied by a competent firm with a demonstrated ability of lining ductile iron. The workmen employed by the applicator shall be experienced and competent in the application of pipe lining and shall have been trained in the application and inspection of the lining compound.

All application equipment, including a special high-speed centrifugal airless device, shall be as recommended by the supplier of the lining compound. Suitable spray equipment or brushes shall be utilized to coat the joint surfaces and the exterior of the pipe. All equipment used shall be maintained in good working condition. Materials and brushes shall be delivered to the job site for field application of lining sections, which may be damaged during installation.

The pipe surface areas to be lined shall be blown off with air to remove all abrasives, dust or other contaminants. Any grease or oil shall be removed by solvent cleaning. The lining shall not be applied under adverse atmospheric conditions that would cause loss of integrity of the applied coating, and in no event when the ambient temperature is less than 40 degrees F.

C. **LINING THICKNESS**

The lining compound shall be thoroughly mixed in accordance with the manufacturer's instructions. After blasting and cleaning, the lining compound shall be applied to all barrel surface areas, which will be exposed to sewer liquids and gases. The lining compound shall be applied to the barrel of the pipe utilizing a suitable application device so as to obtain a continuous and relatively uniform and smooth integral lining in two or more coats. The first coat shall consist of (20 mils wet) 16 mils minimum dry film thickness and the finish coat(s) shall be applied to yield a total minimum dry film thickness of 40 mils for the complete system. The material supplier's re-coat instructions shall be strictly followed. After coating the barrel surfaces, special care shall be given to assure that all joint surfaces exposed to sewer liquids and gases are given a prime and finish coat resulting in a minimum dry film thickness of 30 mils. Because of the extremely rough profile of ductile iron pipe and to insure adequate protection, the amount of material required to achieve the desired film thickness shall be calculated and that amount shall be applied to the surface. When measured with a properly calibrated magnetic film thickness gauge, the cured coating

shall not read less than 36 mils for the barrel and joint surfaces.

D. **PRODUCTION DATE MARKING**

Each day's production shall be marked with the date that the lining system is completed and inspected using a suitable, permanent marker.

E. **TESTING**

Holiday detection on the cured coating shall be performed using a low voltage, wet sponge detector similar to Tinker and Rasor Model M-1 for each pipe section and fitting.

F. **DAMAGE REPAIR**

All damaged areas, holidays and insufficient milling shall be repaired in accordance with the manufacturer's recommendation so that the repaired area is equal to the undamaged areas in all respects.

Equipment used to handle and transport the lined pipe shall be suitably designed and operated so as to not damage the coating. Should damage occur, the damaged areas shall be repaired so that the repaired area is equal to the undamaged areas in all respects.

Lined surfaces of the pipe shall be permitted as long a drying time as practical, but in any event until the finished coating has dried at least five days at 70 degrees F. All phases of the lining process and repair procedure shall conform to the manufacturer's recommendations.

2. **LINING SYSTEM NO. 2**

A. **MATERIALS**

The lining material for pipe and fittings shall be polyethylene complying with ANSI/ASTM D1248, compounded with an inert filler and with sufficient carbon black to resist ultraviolet rays during above ground storage of the pipe and fittings. Prior to preheating, the high temperature oxide film shall be removed by sandblasting through proper preparation of pipe interior surfaces. Fittings shall be preheated to a temperature adequate to provide uniform fusing of the polyethylene powders and proper bonding to the pipe and fittings.

B. **APPLICATION**

Polyethylene linings shall cover the inner surface of the pipe or fitting from the plain or beveled end to the rear of the gasket socket.

C. **LINING THICKNESS**

Lining in pipe and in fittings shall be 40 mils nominal thickness. Minimum lining thickness shall be 30 mils, except for areas not to exceed 12 inches in any direction, minimum thickness shall be 25 mils. At ends of pipe and fittings, lining thickness may taper for a distance of 4 inches to a minimum of 10 mils thickness.

D. **TESTING**

The lining at the ends shall be hermetically sealed and every pipe and fitting shall be subjected to and pass a 400 volt wet sponge, or equivalent, spark test.

For either lining system, the pipe joints shall be caulked utilizing a single component, polyurethane base sealant, "Grove International, Inc. Mono-caulk 100", or approved equal.

		The pipe shall be coated by encasement, in a polyethylene protective wrapping in conformance with MAG Specification Section 610.5. A sealant material that can be brush applied in the field shall be provided and applied in the field for lining damage caused during pipe installation. Measurement will be made horizontally from centerline to centerline of manholes and/or fittings for the various sizes of pipe called out in the plans and in the bidding schedule. On City of Chandler projects only, the payment for the various sizes of ductile iron sewer pipe will be made at the unit price bid per linear foot. This price shall be full compensation for furnishing and installing new pipe and fittings complete in place, as specified, including all excavation, backfilling, bedding, compacting, sheeting and bracing, testing, and all incidental work not specifically covered in other pay items.

Municipality	Supplements
SC:	**615.7 SANITARY SEWER SERVICE TAPS:** * All taps shall be the 45-degree wye type. All sanitary sewer service taps constructed with a wye, shall be marked with electronic locators. Electronic ball locators shall be four-inch diameter, self-leveling type, operating at a frequency of 121.6 kHz and be capable of detection to a depth of 5 feet. Color of the electronic locator shall be green. The sealed end of sanitary sewer taps at property lines shall be marked with a 2 inch x 4 inch x 30 inch long wooden stake or metal stud. The stake shall be driven firmly into the ground exposing a minimum of 12 inches of the stake. The stake shall be labeled to indicate "sewer tap".

615.8 SANITARY SEWER CLEANOUTS:

The cleanouts shall be constructed at locations shown on the plans, in accordance with the standard details for cleanouts.

615.9 MANHOLES:

Manholes shall be constructed to conform with the requirements of Sections 625, Section 505 and standard details.

615.10 BACKFILLING:

Backfilling and compaction shall be done in accordance with Sections 601 and 603, for HDPE pipe.

Municipality	Supplements
SC:	**615.10 BACKFILLING:** Completed sanitary sewer lines shall not be backfilled until inspected and approved by the COS Field Engineering Manager or designed representative.

615.11 TESTING:

Pressure testing of force mains shall be done in accordance with Section 610.14.

Sewers and pipe lines shall be subject to acceptance testing after backfilling has been completed but prior to the placement of the finished surface material.

The Contracting Agency reserves the right to require testing of the entire installation. Cost of repairs or corrections necessary to conform to the following testing requirements will be borne by the Contractor at no additional cost to the Contracting Agency.

(A) Low Pressure Air Test:

Testing will be accomplished by the means of "Low Pressure Air Testing." Tests may be conducted by the Contractor or an independent testing firm. However, acceptance tests shall be made only in the presence of the Engineer.

Test Procedure:

(1) Before testing, the pipe shall be thoroughly cleaned.

(2) The Contractor shall seal off the section of pipe to be tested at each manhole connection. Test plugs *must be securely braced* within the manholes.

(3) A minimum of two connecting hoses to link the air inlet test plug with an above ground test monitoring panel must be provided.

(a) One hose is to induce air through the test plug and into the test chamber.

(b) The second hose is for the purpose of monitoring the test pressure from within the enclosed pipe.

(4) UNDER NO CIRCUMSTANCES ARE WORKERS TO BE ALLOWED IN THE CONNECTING MANHOLES WHILE A PRESSURE TEST IS BEING CONDUCTED.

(5) Add air slowly into the test section. After an internal pressure of 4.0 psi is obtained, allow internal air temperature to stabilize.

(6) After stabilization period, adjust the internal air pressure to 3.5 psi, disconnect the air supply and begin timing the test.

(7) Refer to Table 615-1 to determine the length of time (minutes) the section under test must sustain while not losing in excess of 1 psi as monitored by the test gauge. If the section of line to be tested includes more than one pipe size, calculate the test time for each size and add the test times to arrive at the total test time for the section.

(8) Sections so determined to have lost 1 psi or less during the test period will have passed the leakage test. Those sections losing in excess of 1 psi during the test period will have failed the leakage test.

(9) Appropriate repairs must then be completed and the line retested for acceptance.

TABLE 615-1

SANITARY SEWER AIR TEST

Minimum Test Time for Various Pipe Sizes*

Nominal Pipe Size, in.	*T* (time), min/100 ft.	Nominal Pipe Size, in.	*T* (time), min/100 ft.
3	0.2	21	3.0
4	0.3	24	3.6
6	0.7	27	4.2
8	1.2	30	4.8
10	1.5	33	5.4
12	1.8	36	6.0
15	2.1	39	6.6
18	2.4	42	7.3

* The time has been established using the formulas contained in ASTM C-828, Appendix.

(B) Hydrostatic Test:

Exfiltration Testing (water):

Sanitary sewer testing by means of exfiltration should only be considered when low pressure air testing cannot be used and only with the approval of the Engineer.

Testing Procedure:

(1) The Contractor shall furnish all equipment for testing.

(2) Seal off the downstream end of the line and fill with water to a minimum head of 4 feet in a stand pipe at the high end.

(3) A period of at least one hour will be allowed for absorption time before making the test.

(4) A suitable meter or method of measuring the quantity of water used is necessary.

(5) The allowable water loss for sanitary sewers shall not exceed 0.158 gallons per hour per 100 feet of pipe per inch of diameter of pipe under a minimum test head of 4 feet above the top of the pipe at the upper end.

(C) Deflection Test for HDPE and PVC Pipe:

In addition to the tests prescribed above, the Contractor shall perform a deflection test on the system as directed by the Engineer. Any part of the installation which shows deflection in excess of 5% of the nominal inside diameter per Section 738 for HDPE pipe or in excess of 5% of the average inside diameter per ASTM D-3034 for PVC pipe, shall be corrected.

After acceptance but prior to the termination of the warranty period, the Contracting Agency may test the long term deflection of the sewer. If the Contracting Agency determines that the deflection has exceeded 7 1/2% of the average inside diameter, that portion of the installation shall be corrected by the Contractor at no cost to the Contracting Agency.

(D) Closed Circuit T.V. Inspection:

The Contracting Agency reserves the right to visually inspect the interior of the sewer line using a television camera. Any defects in the pipe or construction methods revealed shall be corrected by the Contractor at no additional cost to the Contracting Agency.

The Contracting Agency will pay for the initial T.V. inspection. Any additional inspection(s) required, due to the failure of the initial inspection, shall be paid for by the Contractor.

Municipality	**Supplements**
SC:	**615.11 TESTING:** *Delete the text of subsection (D) Closed Circuit T.V. Inspection, and insert the following:* All new sewer lines shall receive a final inspection by video viewing and taping. Defects will require correction and reinspection, the second and any subsequent video-taped inspections shall be at the contractors expense. All video tapes become the property of the City of Scottsdale Water Resources Department, Operations Division. *Add the following subsection:* (E) Sewer Force Main Testing: Prior to issuance of Certificate to Operate, all force mains shall be pressure tested. Preparatory to testing, the section of the pipeline to be tested shall be filled with water and placed under a slight pressure for at least forty-eight (48) hours. The pipeline shall then be brought up to one hundred fifty (150) psi or to one hundred twenty-five (125) percent of maximum system operating pressure, whichever is greater, and shall be maintained on the section under test for a period of not less than four (4) hours with no (0) leakage.

615.12 PAVEMENT AND SURFACING REPLACEMENT:

Pavement and surfacing replacement shall be done in accordance with Section 336.

615.13 CLEANUP:

The Engineer has the right to close down forward trenching and pipe laying where testing, backfill, compaction and cleanup does not follow in an orderly manner.

615.14 MEASUREMENT AND PAYMENT:

(A) Sewer Pipe and Fittings: (Vitrified clay, cast iron and other approved types of pipe.)

Measurement will be made horizontally through manholes and fittings and from centerline to centerline of structures, for the various types and sizes of pipe called for on the plans and in the proposal.

Payment for the various sizes and types of pipe will be made at the unit price bid per linear foot, and shall be compensation in full for furnishing and installing the pipe and fittings complete in place, as specified, including excavation, removal of obstructions, backfilling, water settling, compaction, sheeting and bracing, testing, and all incidental work not specifically covered in other pay items.

(B) Sanitary Sewer Service Taps:

Measurement will be the number of taps installed.

Payment will be made at the unit price bid and shall be compensation in full for furnishing and installing pipe and fittings complete in place, as specified and called for on the plans and standard details, including all cost of excavation, removal of obstructions, shoring and bracing, backfilling, compaction, pavement replacement, maintenance of traffic, and all work incidental thereto.

(C) Sanitary Sewer Cleanouts:

Measurement will be the number of cleanouts installed.

Payment will be made at the unit price bid and shall be compensation in full for furnishing and installing pipe, fittings, and frame and cover as called for on the plans and in accordance with the standard details.

RECLAIMED WATER LINE CONSTRUCTION

616.1 GENERAL:

This specification prescribes standards for utility water mains for the purpose of conveying, under pressure, reclaimed water for permitted reuse. Installation of reclaimed water mains shall be constructed in accordance with these specifications for materials, installation, and identification.

616.2 MATERIALS:

Pipe materials shall be in accordance with Section 610.

Valves shall be in accordance with Sections 610 and 630.

Valve boxes shall be in accordance with Section 345, this Section and Detail 391. Manholes shall be in accordance with Section 625, 787 and this Section, and applicable Details.

616.3 INSTALLATION:

Pipe shall be installed in accordance with Sections 601, 610, and this Section.

Valves and risers shall be installed in accordance with this Section.

Valve box debris caps shall be installed in accordance with this Section and Detail 392.

When a reclaimed water main is adjacent to or crosses a potable water main, the reclaimed water main shall be considered a pressure or force sanitary sewer and comply with Detail 404 for separation and/or protection. When reclaimed water main is adjacent to or crosses a gravity, pressure or force sanitary sewer, the reclaimed water main shall be considered a potable water main and comply to Detail 404 for separation and/or protection.

616.4 IDENTIFICATION:

The color purple shall be used for identifying all pipes, values, and other equipment used for conveying reclaimed water.

Reclaimed water identification tape shall be an inert polyethylene plastic impervious to all known alkalis, acids, chemical reagents and solvents likely to be encountered in the soil. The tape shall be a minimum of 4.0 mils thick and no less than 3 inches wide. The tape shall be purple and shall have the words, “CAUTION: RECLAIMED WATER LINE” or similar wording printed in black lettering continuously along the entire length. Lettering shall be a minimum 1 1/2 inches high. Spacing between the individual words of the message shall not exceed three inches.

Reclaimed water identification sleeving (pipe socks) shall be an inert polyethylene plastic that is impervious to all known alkalis, acids, chemical reagents and solvents likely to be encountered in the soil. The sleeving shall be a minimum of 4.0 mils thick. The sleeving shall be purple and shall have the words, “CAUTION: RECLAIMED WATER LINE” or similar wording printed in black lettering continuously along the entire length. Lettering shall be a minimum 1 1/2 inches high. Spacing between the individual words of the message shall not exceed three inches.

Reclaimed water identification decals shall be made of inert material resistant to cracking, peeling, and fading due to sunlight and heat. Decals shall have an aggressive adhesive to ensure permanent bonding to the surface that is being identified. The decals shall have the words, “CAUTION: RECLAIMED WATER - DO NOT DRINK” or similar wording printed in black lettering on a purple background. Lettering shall be a minimum 1 inch high. Spacing between the individual words of the message shall not exceed three inches.

Reclaimed water pipe identified by stenciling shall use paint or ink resistive to all known alkalis, acids, chemical reagents and solvents likely to be encountered in the soil. Stenciled pipe shall have the words, “CAUTION: RECLAIMED WATER - DO NOT DRINK” or similar wording printed in black or white lettering on a purple background continuously along the entire length. Lettering shall be a minimum of 1 1/2 inches high. Lettering shall be placed on a painted purple band a minimum of 3 inches wide that runs the entire length of the pipe.

Reclaimed water locating tape shall be an inert polyethylene plastic that is impervious to all known alkalis, acids, chemical reagents and solvents likely to be encountered in the soil. The tape shall be a minimum of 4.0 mils thick, 3 inch wide and contain a minimum thickness of 1/3 mil metallic foil or two embedded copper wires. The tape shall be purple and printed with the words, "CAUTION: RECLAIMED WATER LINE BELOW" or similar wordings printed in black lettering continuously along the entire length. Lettering shall be a minimum 1 1/2 inches high. Spacing between the individual words of the message shall not exceed three inches.

Integral colored reclaimed water pipe shall be purple in color and shall have the words, "CAUTION: RECLAIMED WATER-DO NOT DRINK" or similar wording printed in black lettering at intervals no greater than 3 feet. Lettering shall be a minimum 1 1/2 inches high. Spacing between the individual words of the message shall not exceed three inches.

Reclaimed water valve tags shall be inert polyethylene plastic that is impervious to all known alkalis, acids, chemical reagents and solvents likely to be encountered in the soil. The tags shall be purple and shall have the words, "CAUTION: RECLAIMED WATER-DO NOT DRINK" or similar wording printed in black lettering. The lettering shall be a minimum of 1/2 inch high.

616.4.1 BELOW-GROUND PIPE:

(A) All below-ground reclaimed water pipelines shall be marked by identification tape, or sleeving, or integral coloring, or stenciling in conformance with this Section.

Identification tape shall be installed parallel to the centerline and on top of the pipe. The identification tape shall be installed continuously for the entire length of the pipe and shall be securely fastened with plastic adhesive tape banded around both the pipe and identification tape at no more than 4-foot intervals.

Identification sleeving shall be installed so the wording runs along the top of the pipe. Care shall be exercised to avoid displacement of sock and to ensure its integrity.

Stenciled pipe shall be installed so the wording is parallel to the centerline and on top of the pipe.

(B) The Agency will need to maintain adequate records, install locating devices, conduct surveys, etc. to be capable of locating all below-ground reclaimed water mains as required by Arizona Revised Statutes 40-360. The means for locating the mains shall be at the discretion of the Agency. When locating tape is used, the tape shall be installed with the printed side up, directly above the pipe, parallel to the centerline, and buried 24 inches below the finished surface grade. The backfill shall be sufficiently leveled so that the tape is installed on a flat surface. Care shall be exercised to avoid displacement of the tape and to ensure its integrity.

In lieu of locating tape, a locating wire can be fastened by plastic adhesive tape to the top center of the pipe. The adhesive tape shall be banded around both the pipe and wire at no more than 4 foot intervals. The wire shall be continuous for the entire length of the pipe, without gaps, breaks, etc. The wire shall terminate above ground in a valve riser housing.

616.4.2 ABOVE-GROUND PIPE:

All above ground pipe shall be identified by stenciling or decals in conformance to this Section.

Stenciled pipe shall be installed so that the wording runs along both sides of the pipe.

Identification decals shall be placed on both sides of the pipe at intervals no greater than 3 feet. Surfaces shall be prepared to ensure proper adhesion of the decals.

616.4.3 VALVES AND RISERS:

Valve handles shall be affixed with tags in accordance with this Section. Tags shall be securely fastened in a manner that ensures their visibility.
Riser pipes shall be painted purple both inside and out from the top of the pipe to at least one foot below the finished grade.

Debris caps shall be required in all valve housings per Detail 392 and shall be colored purple and affixed with tags in accordance with this Section. Tags shall be securely fastened in a manner that ensures their visibility.

616.4.4 VALVE AND MANHOLE COVERS

Valve and manhole covers shall be stamped with the words or shall have raised lettering with the words "RECLAIMED WATER". Reclaimed water valve covers shall be of a shape that is not interchangeable with potable water valve covers.

Municipality	Supplements
CH:	**SPECIFICATION NO. 9:** ***RECLAIMED WATER LINE CONSTRUCTION*** MAG Specifications Section 616 will apply to Reclaimed Water Line Construction with the following exceptions and modifications: 1) The color "red" as stated in the MAG Specifications will be changed to purple, which is standard color "Pantone 512". 2) Marking tape shall be purple (Pantone 512) in color with the following message printed thereon: "WARNING – RECLAIMED WATER – DO NOT DRINK". 3) The exterior of PVC or other plastic type pipes will be Pantone 512 in color. Pipe that cannot be purple in color will be marked as per MAG Standard Specification 616.3. 4) For Small and Large Water User Reclaimed Water Turn-Outs, see City of Chandler Standard Details Number C-404 and C-405. 5) All Reclaimed Water Valve boxes will be 8 1/4" square. See City of Chandler Standard Details Number C-406. 6) Lake Boundaries – City of Chandler Standard Details Number C-407.

STORM DRAIN CONSTRUCTION

618.1 DESCRIPTION:

This section covers concrete pipe line and high density polyethylene (HDPE) pipe line construction used for the conveyance of irrigation water and storm drainage in streets, easements, and alley right of ways, under low hydrostatic heads.

Installation of pipe in laterals of Salt River Valley Water Users' Association or other irrigation districts shall conform to the specifications and permit of the respective irrigation district.

Installation of pipe in State Highways shall conform to the specifications and permit of the Arizona Department of Transportation.

618.2 MATERIALS:

The concrete pipe and HDPE pipe, specials, joints, gaskets, and testing shall be according to Sections 620 or 735, 736 and 738, except as specified below or as modified by special provisions.

(A) Specials: Pipe specials such as closure pieces, wyes, tees, bends, and manhole shafts shall be provided as indicated on the plans, and such specials shall be made equal in strength, diameter, and other physical characteristics to the standard straight pipe lengths by the use of extra concrete, extra reinforcing, or steel items. Drawings of specials shall be submitted to the Engineer for approval before their fabrication.

(B) Rubber Gasket Joints: When rubber gasket pipe is used, the joint shall be sealed with a continuous ring gasket made of a special composition rubber of such size and cross section as to fill completely the recess provided for it. The gasket shall be the sole element depended upon to make the joint watertight, and shall have smooth surfaces, free from pits, blisters, porosity, and other imperfections. The rubber compound shall contain not less than 60% by volume of first grade synthetic rubber.

The remainder of the compound shall consist of pulverized fillers free from rubber substitutes, reclaimed rubber and deleterious substances. The compound shall meet the following physical requirements when tested in accordance with appropriate ASTM Specifications:

(1) Tensile Strength of the compound shall be at least 2,100 psi, ASTM D-412.

(2) Elongation at Rupture shall be at least 400%, ASTM D-412.

(3) Shore Durometer Hardness, Type A, Value 40 - 60(±5), ASTM D-2240.

(4) Cold Flow: The percentage shall not exceed 20. The determination shall be made in accordance with Method B ASTM D-395, with the following exception. The disc shall be 1/2″ thick and the diameter shall be that of the rubber gasket. The gaskets shall not be exposed to direct sunlight for a time greater than needed to accomplish normal installation.

(5) Specific Gravity shall be consistent within +0.05 and shall be between 0.95 and 1.45, ASTM D-297.

(6) Rubber Gaskets for HDPE pipe shall be in accordance with Subsection 738.2.3.

(C) Water Stops: Water stops will be required when connecting HDPE pipe to concrete structures, manholes, etc. The water stop shall comply with Section 738 and will be installed per manufacturer recommendations.

(D) Cement Mortar Joints for RCP will be in accordance with Subsection 736.3.

618.3 CONSTRUCTION METHODS:

Excavation, bedding, backfilling, and compaction or consolidation of backfill and bedding of trenches shall be accomplished in accordance with Sections 601 and 603 for HDPE pipe, except as specified below, or as modified by special provisions.

The Contractor shall over-excavate the trench and fill with select materials in accordance with standard details.

Where the cover over the top of the pipe is less than 10 feet, the maximum trench width is unrestricted. The pay width, however, for pavement replacement shall remain in accordance with Section 336. For pipe, with 10 feet or more cover, the maximum trench

width shall be as required by Sections 601 and 603 for HDPE pipe.

The laying of the pipe shall be in finished trenches free from water or debris, and shall be commenced at the lowest point, with the spigot ends pointing in the direction of the flow. Each pipe shall be laid firmly and true to line and grade, in such manner as to form a close concentric joint with the adjoining pipe and to prevent sudden off-sets of the flowline. Any adjustment to line and grade shall be made by scraping away or filling in under the body of the pipe, never by wedging or blocking under the pipe ends.

Variation from prescribed alignment and grade shall not exceed 0.10 foot and the rate of departure from or return to established grade or alignment shall be no more than 1 inch in 10 feet of pipe line unless otherwise approved by the Engineer. For closures and deflection angles greater than 10 degrees, joints shall be made by use of a bend, specially manufactured fitting, or by a concrete collar, per standard details.

Pipe shall be of the type, class and size shown on the plans or in the special provisions.

All pipe, for permit construction, shall be reinforced concrete pipe, ASTM C-76 Class III or HDPE pipe in accordance with ASTM F-894, AASHTO —252 or AASHTO —294. For reinforced concrete pipe, the minimum cover from the top of the pipe to the finished grade shall be 2 feet and the maximum cover shall be 12 feet. The minimum and maximum cover for HDPE pipe shall be as specified in the special provisions or the manufacturer's recommendations.

All pipes installed under railroad tracks shall be reinforced concrete pipe, ASTM C-76, Class V and the minimum cover over all pipes shall be as specified in the railroad permit and/or special provisions. Bedding shall be in accordance with standard details.

The allowable water loss for irrigation lines shall not exceed 2 gallons per hour per 100 feet of pipe per inch of diameter of pipe, under a minimum test head of 1 foot above the top of the pipe at the upper end when tested in accordance with the procedures of Section 615.

618.4 JACKING PIPE:

At locations where jacking is required, the storm drain line shall be installed by jacking to the lengths indicated on the plans, in accordance with the following. The methods and equipment used in jacking reinforced concrete pipe conduit shall be optional with the Contractor, provided that the proposed method is first approved in writing by the Engineer. Such approval, however, shall in no way relieve the Contractor of the responsibility for damages of any nature which might occur as a result of the methods used.

Only workmen experienced in the operation of jacking concrete conduit shall be used.

The driving ends of the conduit shall be properly protected and the conduit shall be driven true to alignment and grade. The deviation from true line and grade at any single point within the jacked portion shall be limited to 0.5 feet horizontal deviation from line and ±0.2 feet vertical deviation from grade.

Any section of conduit which may show signs of failure shall be removed and replaced with a new section of precast conduit or with a cast-in-place section, which in the opinion of the Engineer is adequate to carry the loads imposed upon it. In this respect it shall be understood that where pipe is specified on the drawings to be jacked into place the jacked pipe shall be reinforced concrete of the strength specified in these specifications and the design of such pipe is based upon superimposed loads and not upon loads which may be placed upon the pipe as a result of jacking operation. Any increase in pipe strength required in order to withstand jacking loads shall be the responsibility of the Contractor. The reinforcing shall be circular and of either single or double cage design.

Spacer blocks shall be placed in the inside circular space which will allow sufficient width for point mortaring when jacking is completed and to equalize pressures during jacking. Three grout holes per 8-foot section of pipe shall be made during manufacturing.

Double rubber gaskets and band type joints shall be provided for 36 inches diameter and larger pipe.

One hole shall be made on the top midway between the ends. Two additional holes, each approximately 1.5 feet from each end and approximately midway between the springline and top on opposite sides shall be made.

Where the nature of the soil, or the structure under which the conduit is being jacked is such that, there is increased danger of a cave-in or damage to said structure, the method of jacking the conduit shall be as specified below.

The leading section of conduit shall be equipped with a jacking head securely anchored thereto to prevent any wobble or alignment variation during jacking operations. The length and details of the jacking head shall be subject to the written approval of the Engineer. Excavation shall be carried out entirely within the jacking head and no excavation in advance thereof will be permitted. Every effort shall be made to avoid any loss of earth outside of the jacking head. Excavated material shall be removed from the conduit as excavation progresses, and no accumulation of such material within the conduit will be permitted. Upon completion of the jacking operations, all voids around the outside face of the conduit shall be filled by grouting through each of the previously constructed grout holes to the satisfaction of the Engineer. The grout shall be a mixture of one part cement to three parts sand and a mixture by volume.

Grouting equipment and material shall be on the job before jacking operations are started in order that grouting around the jacked conduit may be started immediately after the jacking operation. After grouting, the holes in the conduit shall be repaired to the satisfaction of the Engineer.

618.5 MEASUREMENT:

(A) Main Line Pipe: Shall be the number of linear feet of pipe laid as measured along the pipe axis.

Unless hereinafter modified, measurement shall extend through manholes when no change in pipe size occurs. When a change in pipe size occurs within a manhole, unless hereinafter modified, measurement for each size will be taken to the centerline of the manhole.

(B) Connecting Pipe: Shall be the number of linear feet of pipe installed, as measured along the pipe axis from a main line pipe, or a manhole, or a catch basin to a catch basin, or a plugged end, and shall include the portions of the connecting pipe embedded in the above structures.

(C) Jacked Pipe: Shall be made at the ground surface and shall be the number of linear feet of ground surface undisturbed by the cut and cover construction on either side of the jacked section.

618.6 PAYMENT:

(A) Main Line Pipe: Will be paid at the unit price bid per linear foot, to the nearest foot, for each size and type of pipe and shall be compensation in full for furnishing and installing the type of pipe as specified and as shown on the plans including removal of obstructions, excavation, bedding, backfilling, compacting, testing, joint materials, joining, collars, and field closures.

(B) Connecting Pipe: Will be paid at the unit price bid per linear foot, to the nearest foot for each size of pipe and shall be compensation in full for furnishing and installing complete in place as shown on the plans and as specified, the connecting pipe and specials including spur connections, removal of obstructions, excavation, bedding, backfilling, compacting, joint materials, joining, collars, field closures, and testing.

(C) Jacked Pipe: Will be paid the same as for main line pipe.

Scottsdale Added the following

SECTION 619
PRECAST REINFORCED CONCRETE BOX SECTIONS

Municipality	Supplements
SC:	**619.1 GENERAL:** This specification covers the furnishing and placing of precast reinforced concrete box sections for use in the conveyance of storm waters under low hydrostatic heads.

Municipality	Supplements
SC:	**619.2 MATERIALS:** (A) Precast reinforced concrete box sections shall conform to the specifications of AASHTO Designation M259 or M273, as controlled by the amount of cover indicated on the plans. (B) Mortar shall consist of one part portland cement and two parts sand, by volume. The quantity of water in the mixture shall be sufficient to produce a soft workable mortar, but in no case shall exceed a water-cement ratio of 0.53. Sand shall conform to MAG Section 701 and portland cement shall conform to MAG Section 725. (C) Preformed joint material shall conform to the requirements of AASHTO Designation M 198, Type B. (D) Bedding material shall conform to the requirements of MAG Section 702, aggregate base course material

Municipality	Supplements
SC:	**619.3 SHOP DRAWINGS:** The Contractor shall submit shop drawings of any specially fabricated sections for the Engineer to review and approve prior to the start of any work.

Municipality	Supplements
SC:	**619.4 SHIPPING AND HANDLING:** Concrete boxes shall be carefully handled during loading, transport, unloading and laying. Boxes which show defects due to handling shall be rejected at the site of installation regardless of any prior acceptance. Any box which is cracked, chipped, spalled or damaged shall be removed from the work site.

Municipality	Supplements
SC:	**619.5 CONSTRUCTION METHODS:** (A) Excavation and backfill: Shall be in accordance with MAG Section 206 except as modified herein. A two (2) inch minimum granular bedding material shall be constructed to provide uniform support for the full length and width of each section. Granular material shall be aggregate base course meeting the specifications of MAG Section 702.2.2. Structural backfill shall not be placed until the installation has been inspected by the Engineer and approved for backfilling. (B) Laying of sections: Placing of the sections shall begin at the downstream end of the line. The grooved ends of the box segments shall be in full contact with the prepared bedding. The box segments shall be checked of for grade and alignment at the time of joining the sections. Box segments shall be joined such that the inside faces are flush and even. Lift holes shall be plugged with mortar and finished smooth and flush with the inside face of the box section.

	(C) Joints: Unless otherwise specified on the plans the Contractor shall have the following options for making joints: (1) Cold applied preformed gaskets: Joints for precast boxes shall be sealed with a flexible, watertight, preformed joint material. Installation shall be per the manufacturer's instructions and recommendations. The joint material shall be protected by a suitable wrapper so designed that when removed at the proper time, the material will maintain its integrity. The size and application of the preformed joint material shall be per the precast box manufacturer's recommendations and shall be sufficient to obtain a visible squeeze out. (2) Mortar joints: The section ends shall be cleaned and wetted before making the joint. The lower half of the bell or groove and the upper half of the tongue or spigot shall be plastered with mortar. Maximum allowable gap tolerance between joints shall be three-fourths (3/4) inch. Any resulting annular space shall be filled with mortar and finished flush with the inside faces of the box. Exterior joints shall be beaded semi-circular one (1) inch to each side of the tongue and groove joint or beveled to form a forty-five (45) degree joint between the outer edge of the bell and spigot. Mortar joints shall be cured by keeping them wet for at least forty-eight (48) hours or until the exterior joints are backfilled, whichever comes first. No joints shall be constructed when the temperature is at or below forty (40) degrees F. Mortared joints shall be protected against freezing for at least forty-eight (48) hours. (D) Alignment and grade: Each precast section shall be checked for alignment and grade. The interior of the boxes shall be kept free of debris and foreign material as the box laying progresses and shall be left clean at the completion of the work. Any box which is not in true alignment or on grade, or shows signs of undue settlement of damage after setting shall be taken up and re-laid at the Contractor's expense. Horizontal or vertical joint deflection shall not exceed the manufacturer's recommendations. Changes in alignment, in excess of those obtainable by allowable joint deflections, shall be made by special manufactured beveled sections or concrete junction structures as detailed on the plans. **619.5.1 Repair** Fine cracks and checks on the surface of a member which do not extend to the plane of the nearest reinforcement shall not be cause for rejection unless the are numerous and extensive as determined solely by the Engineer. Cracks which extend into the plane of reinforcement, but are otherwise acceptable, may be repaired by a method acceptable to the Engineer.

Municipality	**Supplements**
SC:	**619.6 MEASUREMENT:** Precast reinforced concrete box sections shall be measured in number of linear feet horizontally along the box centerline from end to end.

Municipality	**Supplements**
SC:	**619.8 PAYMENT:** Payment will be made at the contract unit price bid per linear foot to the nearest foot for each size of precast reinforced concrete box installed, which shall be full compensation for the item complete and in place as described herein and on the plans.

CAST-IN-PLACE CONCRETE PIPE

620.1 GENERAL:

This specification covers cast-in-place non-reinforced concrete pipe intended for use as storm sewers or irrigation lines. The abbreviated title is CIPP. CIPP is conduit made of portland cement concrete cast monolithically in a properly prepared trench, using equipment specifically designed for this purpose. The type of equipment to be used by the Contractor must be approved by the Engineer and the Contractor may be required to furnish evidence of the successful use of this equipment on prior work. CIPP will be placed only:

(A) By experienced operators. The Engineer will be the sole judge as to experience level.

(B) In the presence of the Engineer.

(C) In ground capable of standing unsupported from the bottom of the trench to the top of the pipe without sloughing.

(D) In fill when it can be demonstrated to the satisfaction of the Engineer that the fill will adequately support the pipe.

Municipality	Supplements
SC:	**620.1 GENERAL:** This specification covers cast-in-place non-reinforced concrete pipe (CIPP) intended for use as storm sewers or irrigation lines. CIPP is conduit made of portland cement concrete cast monolithically in a properly prepared trench, using equipment specifically designed for this purpose. The type of equipment to be used by the Contractor must be approved by the Engineer and the Contractor may be required to furnish evidence of the successful use of this equipment on prior work. CIPP will be placed only: (A) By experienced operators. The Engineer will be the sole judge as to experience level. (B) In the presence of the Engineer or designated representative. (C) In ground capable of standing unsupported from the bottom of the trench to the top of the pipe without sloughing. (D) In fill when it can be demonstrated to the satisfaction of the Engineer that the fill will adequately support the pipe. (E) When designated as an allowable storm sewer pipe material in the project specifications. This designation is no warranty, expressed or implied, that conditions will be suitable for the use of CIPP. Any costs incurred and/or time required to provide suitable conditions or to substitute an alternate pipe acceptable to the Engineer, in whole or in part, shall be the responsibility of the Contractor. CIPP will not be placed at locations where other materials have been specifically shown or noted on the plans.

620.2 MATERIALS:

620.2.1 Cement shall be ASTM C-150, Type II, low alkali as per Section 725.

620.2.2 Sand aggregate used for concrete and mortar shall conform to Section 701. Maximum size of the aggregate shall not be greater than _ of the minimum wall thickness up to and including a wall thickness of 4 1/2 inches. The maximum aggregate size is 1 1/2 inches.

620.2.3 Water used for concrete and for curing the pipe shall be as per Section 725.

620.2.4 Concrete shall be Class A in accordance with Section 725. Slump shall be the minimum required for satisfactory placement of the concrete by the equipment used by the Contractor. The slump shall not exceed 3 inches.

620.2.5 Bonding mortar shall consist of two (2) or more parts of cement to three (3) parts of sand by volume.

620.3 CONSTRUCTION METHODS:

620.3.1 Excavation: The trench will be neatly excavated with vertical sides and semi-circular bottom. The trench shall be shaped to form the bottom outside of the pipe on the alignment and to the grades specified in the plans. Departure from and return to established grade shall not exceed 1 inch per 10 linear feet with a maximum allowable departure of 1 1/2 inches. Departure from and return to specified alignment shall not exceed 2 inches per 10 linear feet with a maximum allowable alignment departure of 4 inches. The bottom of the trench, hereinafter known as the trench form, will be shaped to provide full, firm, and uniform support by undisturbed earth or compacted fill for at least the bottom 210 degrees of the pipe. Density of the fill shall be at least five percent (5%) greater than the natural inplace soil, but in no case less than 85 percent (85%) when tested in accordance with AASHTO T-99, Method A and T-191 or ASTM D-2922 and D-3017.

When it is necessary to install the pipe in rocky areas, the rock will be removed and replaced with suitable fill material compacted to proper density. The rock will be over-excavated to leave a 6 inches minimum compacted soil cushion between the rock and the pipe. For construction accuracy, areas left void by rock removal will be completely filled with compacted material, then trenched for the pipe as though natural ground. If the rock below the pipe subgrade is fractured or fragmented or if it consists of large cobblestones or boulders, the replacement fill material will be carefully selected to insure that it is of such gradation that it will not be removed downward by fluctuation of the water table. In no case will expansive soils be used for fill. A similar procedure of over-excavation, backfill, compaction, and retrenching will be used where sloughing sand or where soft or spongy soil conditions are encountered. When expansive clays are encountered, they will be thoroughly moistened by ponding, to completely expand the soil, and the moisture maintained until the concrete is placed.

Where the pipe is to be constructed through fill materials, such fill shall have stability in the zone of the trench form equal to firm undisturbed earth, in the area adjacent to the fill.

Upon direction of the Engineer, the Contractor shall substitute RCP or an acceptable alternate at locations where the conditions are unsuitable for CIPP. All cost for this substitution shall be borne by the Contractor.

620.3.2 Placement: At the time of concrete placement, all soil in the trench will be adequately moistened so that water is not drawn from the freshly placed concrete. However, the trench form will be completely free of water, mud, and debris. All forming devices, including the slipforms and hopper of the placement device, shall be thoroughly moistened.

Concrete shall not be placed when temperature of the concrete exceeds 90 degrees Fahrenheit or is less than 50 degrees Fahrenheit. The soil adjacent to the trench shall be at a temperature above freezing.

The pipe shall be constructed in one placement, the entire cross-section being placed monolithically. Inside forms shall be sufficiently rigid to withstand consolidation of the fresh concrete. Placement shall be such as to produce a thoroughly consolidated homogeneous concrete mixture conforming to the test requirements of this specification. Effective consolidation means shall be applied to the fresh concrete over the entire circumference and from within the pipe shell. Consolidation means shall be capable of effectively placing and consolidating fresh concrete at production speeds. Methods of consolidating shall be capable of building up sufficient pressure to effectively bond the concrete to the surrounding earth and to keep loose sand, mud, and water out of the pipe shell.

(A) Construction Joints:

When work is stopped at the end of a placement or for any period that would permit initial set to take place, a construction joint shall be formed. The ends of the pipe that are to be in butt contact shall be left in rough condition with a slope of approximately 45 degrees. Before resuming, if the pipe diameter is 60 inches or less, an excavation shall be made along the sides and bottom of the joint to permit casting of a concrete collar around the outside of the joint. This collar shall have a minimum thickness of 11/4 times the wall thickness of the pipe and shall lap the entire joint by at least two (2) times the wall thickness. Immediately before resuming concrete placement the surfaces to be bonded shall be cleaned of all laitance, coatings, foreign materials, and loose or defective concrete, thoroughly wetted and coated with a layer of bonding mortar (Subsection 620.2.5) approximately 1/4 inch thick. In lieu of the bonding mortar, neat cement paste may be thoroughly scrubbed onto the wet surface of the previously placed concrete.

For a joint that may be used for connections to another pipe or structure, a joint shall be made by squaring off the end of the pipe. An excavation shall be made along the sides and bottom of the cast-in-place pipe, for any diameter, to permit casting of a concrete collar as described above.

The outside top of all joints shall be capped for the entire width of the pipe that is exposed, that is, between the earth walls of the excavated trench. This cap shall have a minimum thickness equal to the wall thickness of the pipe and shall lap the joint, both upstream and downstream from the joint by at least twice the wall thickness of the pipe. A cap as described is required regardless of pipe size.

(B) Pipe Dimensions and Tolerances:

(1) The internal diameter of the pipe at any point shall not be less than 95 percent of the nominal diameter, and the average of any four (4) measurements of the internal diameter made at 45 degree intervals shall not be less than the nominal diameter.

(2) For pipe less than 15 inches inside diameter, the minimum wall thickness shall be 2 inches.

For pipe with an inside diameter of 15 inches to 24 inches the minimum wall thickness shall be 2 1/2 inches. For pipe exceeding 24 inches inside diameter, the minimum wall thickness shall be 1/12 of the inside diameter, plus 1/2 inch.

(3) Offsets at form laps and horizontal edges shall not exceed 1/2 inch for pipe having inside diameter not greater than 42 inches; 3/4 inch for pipe having inside diameter greater than 42 inches, but not greater than 72 inches; and 1 inch for pipe having inside diameter greater than 72 inches.

(C) Pipe Placement:

(1) It is essential that concrete placement be done in a smooth and steady manner with as few starts and stops as is possible. The Contractor shall schedule materials and operate the pipe machine at speeds and in a manner that will achieve this.

(2) The Contractor shall provide an anchoring system for pull of the machine in a manner which will provide the least probability of causing deviations in grade and/or alignment. Adjustments to or modifications in anchoring system, when required in the opinion of the Engineer, shall be made at no additional cost to the project.

620.3.3 Curing and Backfilling: The Contractor shall be responsible for proper curing of the concrete and backfilling the trench to an even grade. Final backfill and compaction shall not be started until concrete has developed a compressive strength of at least 2,000 psi. Curing shall be performed in such a manner as to prevent the premature drying of the concrete. The Contractor shall use one of the four methods described below.

(A) A 3 inch layer of moist loose soil or sand shall be carefully placed over the top of the pipe immediately after the pipe is cast. The backfill shall be material free of clods and rocks having a diameter greater than 2 inches and any other deleterious foreign materials. The backfill shall be carefully placed over the top of the pipe to prevent damage to the wet concrete. The thickness of the backfill shall be increased by 9 inches after initial set of the concrete has occurred. The backfill shall be kept moist at all times until the pipe has been covered to a depth of 12 inches or more.

(B) The exposed top portion of the pipe may be covered with wet burlap or other material of high moisture retentive properties immediately after the pipe is cast. The covering material shall be kept continuously moist until the placement of final backfill as described above. Moisture retentive material may be removed or left in place at the option of the Contractor.

(C) A pigmented membrane-curing compound conforming to ASTM C-309 may be applied to the exposed surface immediately after the pipe is cast. The compound shall be applied at the rate of not less than one (1) gallon for each 150 square of exposed concrete. The pipe shall then be covered with a minimum of 3 inches of moist loose soil when the curing compound is sufficiently hard to resist damage from the fill. Final backfill shall be placed when the pipe attains suitable strength.

(D) Polyethylene film complying with ASTM C-171, nominal thickness 0.0015 inches, may be placed on the exposed top surface of the pipe immediately after the pipe is cast. The film shall be anchored in place with loose soil to assure continuous, adequate curing. The trench shall be completely backfilled as soon as the pipe attains suitable strength.

A humid atmosphere within the pipe, as evidenced by condensation on the interior surface, shall be maintained for at least seven (7) days following placement, except for a maximum period of 48-hours allowed for removing forms and making repairs. To

prevent air drafts which may dry the pipe and to maintain a humid atmosphere inside the pipe, all openings into the pipe line shall be kept closed or covered, except when and where work is actually in progress on the inside of the pipe. If necessary to promote high humidity, the pipe line will be partially filled with ponded water during the curing period.

Municipality	Supplements
SC:	**620.3.3 Curing and Backfilling** The Contractor shall be responsible for proper curing of the concrete and backfilling the trench to an even grade. Final backfill and compaction shall not be started until concrete has developed a compressive strength of at least 2500 psi (17.3 MPa). The pipe shall be checked for grade, alignment and thickness prior to backfilling. Backfill and ABC slurry shall conform to the requirements of COS Standard Detail No. 2201, or as specified on the plans. Curing shall be performed on such a manner as to prevent the premature drying of the concrete. The Contractor shall use the method described below. Polyethylene film complying with ASTM C-171, nominal thickness 0.0015 inches (0.038 mm), shall be placed on the exposed top surface of the pipe immediately after the pipe is cast. The film shall be anchored in place with loose soil to assure continuous, adequate curing. A humid atmosphere within the pipe, as evidenced by condensation on the interior surface shall be maintained for at least seven (7) days following placement, except for a maximum period of 24 hours allowed for removing forms and making repairs. To prevent air drafts which may dry the pipe and to maintain a humid atmosphere inside the pipe, all openings, ends, manholes, and connector pipes shall be kept closed or securely covered, except when actual work is in progress on the inside of the pipe. The pipeline shall be partially filled with water during the curing period when work is not being performed on the inside of the pipe.

620.3.4 Repair: Care shall be taken when removing the forms that the pipe is not damaged. Immediately after the removal of the forms, the inside of the pipe shall be inspected and all required repairs made before final backfilling begins. All spalls, cracks or indentations not satisfying Subsection 620.3.2(A) shall be filled with mortar per Subsection 620.2.5. Cracks may be repaired with epoxy materials.

Longitudinal cracks exceeding 0.01 inches in width and 12 inches in length shall be cause for rejection of the pipe. The pipe section or reach in question shall either be removed and replaced or shall be repaired in a manner approved by the Engineer.

Municipality	Supplements
SC:	**620.3.4 Repair** Immediately after removal of the forms, the inside of the pipeline will be inspected for required repairs and conformance with all dimensional requirements including alignment and grade. The Engineer shall be the sole judge as to the repairability of the deficiencies. Those sections of pipeline which are judged to be non-repairable or which are not within required dimensional tolerances, including alignment and grade, shall be removed and replaced. When concrete placement is done by a method requiring the use of metal inner forms, the Contractor shall schedule work forces, by extended, staggered or multiple shifts, as required, to provide for removal of forms within 4 to 6 hours of placement of concrete and start of repairing, patching and finishing of pipeline to conform with specification requirements. When concrete placement is done by methods using pneumatically inflated inner liner, the Contractor shall schedule work forces, by extended, staggered or multiple shifts, as required, to provide for removal of the pneumatic inner liner within 12 hours of placement of concrete and start of repairing, patching and finishing of pipeline to conform with specification requirements. All rock pockets, non-longitudinal cracks or indentations shall be cleaned out, moistened and filled with 1:2 cement grout or approved epoxy material. Except where, in the opinion of the Engineer, the width and/or length

	of the crack may indicate a structural deficiency, repairs shall be made as required for longitudinal cracks. At the discretion of the Engineer, longitudinal cracks exceeding 0.01 inches (0.25 mm) in width and 12 inches (305 mm) in length may be cause for rejection and removal of that portion of the pipe. Subject to the approval of the Engineer, cracks may be repaired using a pressure applied epoxy compound capable of providing structural correction to the area in addition to sealing the void. A longitudinal crack shall be defined as one which the general direction of a 30 degree angle or less with the alignment of the pipe. Irrespective of concrete placement method, all repairs, patches and finishing shall be completed within 24 hours of concrete placement. The Contractor, prior to start of concrete placement on project shall submit a written schedule of proposed work activities and work time schedules for the Engineer's review and approval. No time schedule requiring overtime by the Engineer's staff is authorized without specific written approval of the Engineer. Compliance with this section is a non-pay item and any costs incurred shall be included in the bid proposal item(s) for the pipe.

620.3.5 Finish: Except for the form offsets the interior surface of the pipe shall be equivalent to or better than a wood float finish. All extraneous concrete shall be removed from the interior surface.

Municipality	Supplements
SC	**620.3.5 Finishing** Except for the form offsets, the interior surface of the pipe shall be equivalent to or better than a wood float finish. Form offsets shall be trimmed so as to provide a reasonably tapered slope from surface to surface. The bottom of the pipe below the metal forms shall be finished in a workmanlike manner and shall conform to the general circular circumference of the pipe without sags, dips and humps. All extraneous concrete shall be removed from the interior surface.

620.4 METHODS OF TESTS:

Wall thickness shall be checked at the top, sides and bottom, every 100 feet. Where thickness is not determined by probes through the fresh concrete, small holes shall be drilled a day or so after placement. The holes shall be properly and permanently closed and sealed, flush with the inside surface of the pipe, after measurements are made.

Test cylinders shall be prepared and tested as per Section 725. If the cylinder tests indicate that the concrete does not meet the specified strength requirements, cores shall be taken from the same section of concrete represented by the faulty test cylinder under the supervision of the Engineer. The concrete should be at least 14 days old before the core specimens are taken. The diameter of the core specimens for the determination of compressive strength should be at least three (3) times the maximum nominal size of the coarse aggregate used and must be at least twice the maximum nominal size of coarse aggregate.

The length of the specimen, when capped, should be twice the core diameter. A core having a maximum height of less than 95 percent of its diameter before capping or a height less than its diameter after capping shall not be tested.

If cores are taken, the Contractor shall patch all core holes in such a manner that the patch will be permanent, will not leak, and will have a smooth interior finish flush with the interior surface of the pipe.

Procedures and payment for coring shall be in accordance with applicable portions of Section 725.

The Engineer will evaluate the test results and his decision as to required corrective action will be final.

Municipality	Supplements
SC:	**620.4 TESTS:** Random tests shall be made of the wall thickness at the top, bottom and sides, approximately every 100 feet, on a daily basis by probes through fresh concrete or small holes drilled through the concrete. Holes shall be properly and permanently closed and sealed, flush with the inside surface of the pipe, after measurements are made, in accordance with the requirements of the fifth paragraph of Subsection 620.3.4, contained herein. The Contracting Agency shall take and test concrete test cylinders per MAG Section 725 for compressive strength testing at 14 and 28 days. Should the Contractor desire to backfill prior to 14 days, it shall be the Contractor's responsibility to schedule, and pay for, any additional concrete test cylinders and provide results to the Contracting agency. Only concrete test results from a certified testing lab, indicating the concrete has developed the minimum 2500 psi compressive strength required herein shall be accepted as justification for allowing backfilling prior to the receipt of the Contracting Agency's concrete test results. Backfilling shall not take place until approved by the COS Field Engineering Manager or designated representative. If the 14 or 28 day cylinder tests indicate that the concrete does not meet the specified strength requirements, cores shall be taken from the same section of concrete represented by the faulty test cylinder under the supervision of the Engineer. The concrete should be at least 14 days old before the core specimens are taken. The diameter of the core specimens for the determination of compressive strength should be at least three (3) times the maximum nominal size of the coarse aggregate used and must be at least twice the maximum nominal size of coarse aggregate. The length of the specimen, when capped, should be twice the core diameter. A core having a maximum height of less than 95 percent of its diameter before capping or a height less than its diameter after capping shall not be tested. If cores are taken, the Contractor shall patch all core holes in such a manner that the patch will be permanent, will not leak, and will have a smooth interior finish flush with the interior surface of the pipe. Procedures and payment for coring shall be in accordance with applicable portions of MAG Section 725. The Engineer will evaluate the test results and a provide final decision as to any required corrective action.

620.5 MEASUREMENT:

Measurement of cast-in-place concrete pipe will be the number of linear feet of pipe measured horizontally along the pipe axis from end to end of the pipe. At changes in diameter, the measurement shall be to center of manhole or transition.

Municipality	Supplements
SC:	**620.5 MEASUREMENT:** Measurement of cast-in-place concrete pipe will be the number of linear feet of pipe measured horizontally along the pipe axis from end to end of pipe. At changes in diameter, the measurement shall be to center of manhole or transition

620.6 PAYMENT:

Payment will be made at the contract unit price bid per linear foot to the nearest foot for each size of pipe and shall be compensation in full for furnishing and installing the cast-in-place concrete pipe as specified, including removal of obstructions, excavation, backfilling, compacting, testing, and all incidental costs not specifically covered in other items in the proposal.

Municipality	Supplements
SC:	**6 PAYMENT:** Payment will be made at the contract unit price bid per linear foot to the nearest foot for each size of pipe and shall be compensation in full for furnishing and installing the cast-in-place concrete pipe as specified, including removal of obstructions, excavation, backfilling, compacting, testing, and all incidental costs not specifically covered in other items in the proposal. No separate payment will be made for prefabricated tees, fittings and/or lateral pipe connections, the costs of which shall be included in the price per linear foot of storm drain line.

CORRUGATED METAL PIPE AND ARCHES

621.1 DESCRIPTION:

These specifications cover plain galvanized, bituminous coated, and bituminous coated and paved galvanized corrugated metal pipe for use in storm sewers. The pipe shall be of the types, constructed as specified, and shall be manufactured in accordance with the requirements of the stated specifications. Except as otherwise required, corrugated metal pipe shall conform to AASHTO M-36 for Type I, Type IA, II and Type IIA. The external coating and internal lining shall be in accordance with AASHTO M-190 and Section 760.

Municipality	Supplements
SC:	**621.1 DESCRIPTION:** *Add pipe classification Type IR to AASHTO Designation M-36.*

621.2 MATERIALS:

The types of pipe and fabrication shall be in accordance with Section 760.

All helically-wound corrugated metal pipe shall have a marking system which shall provide a quick external visual check of diameter variations during and after the manufacturing process.

Municipality	Supplements
SC:	**621.2 MATERIALS**: *Add the following:* All prefabricated fittings for lateral pipes shall be welded fittings. Rubber "O" ring gaskets shall conform to the requirements of ASTM C-361. Sleeve gaskets shall be a closed cell rubber in accordance with ASTM D-1056, grade SCE 43

Scottsdale Adds the Following:

Municipality	Supplements
SC:	**621.2.1 Material Handling:** The Contractor is responsible for seeing that the pipe arrives and is installed undamaged. During loading, transportation, unloading, storage and laying, every precaution shall be taken to prevent damage to the corrugated pipe, linings and coatings. Approved slings of nylon or other suitable material which will minimize point loading and coating abrasion shall be used during all handling operations and to install the pipe in trenches. The straps of the slings shall be spaced closely so as to ensure a minimum deflection in the pipe to preserve the integrity of the mortar lining. Under no circumstances shall holes be made in the pipe for lifting purposes. Open ends of shop-applied, mortar lined pipe shall be tightly sealed using polyethylene plastic wrap with a minimum thickness of 6-mil. The ends of the pipe shall remain tightly sealed for a period of time as determined by the mortar applicator to adequately cure prior to shipment. Any damage to the lining or coating occurring at any point in transit or during installation shall be repaired as described in COS Subsection 760.6 if, in the opinion of the City, a satisfactory repair can be made. Otherwise, the damaged section shall be removed from the job site and replaced at the expense of the Contractor.

621.3 INSTALLATION:

Excavation, bedding and backfill shall be in accordance with Section 601, except as modified by standard details.

No pipe shall be laid except in the presence of an inspector. Each pipe shall be carefully inspected immediately before it is laid and defective pipe will be rejected. Pipe lines shall be laid to the grades and alignment indicated on the drawings. Variation from prescribed grade and alignment shall not exceed 0.10 foot, and the rate of departure from, or return to established grade or

alignment shall be no more than 1 inch in 10 feet, unless otherwise approved by the Engineer. Proper facilities shall be provided for lowering sections of pipe into trenches. All pipes, elliptical or round, as well as pipe arches requiring external coating or internal lining shall be equipped with lifting lugs as required and shall have connecting bands designed to provide positive connection without damaging the coating on the pipe or pipe arch.

All field repairs to the bituminous coating or paving shall be made with approved fiber reinforced bituminous mastic.

Corrugated metal pipe and/or pipe arches shall be laid with separate section joined together in such a manner that the joint space shall not exceed 1/2 inch, with the outside laps of circumferential joints pointing upstream and with longitudinal laps on the side. Elliptical pipe shall be installed so that the major or minor axis, whichever the case may be, and which should be indicated by suitable markings on the top of each end of the pipe sections, coincides with the survey alignment of the trench excavation. Any metal in the joints which is not thoroughly protected shall be coated with bituminous mastic. During the installation, the pipe shall be handled with care so as not to damage the external coating or internal lining. Coupling band bolts and damaged areas of the coupling bands and pipe shall be given a coating of bituminous mastic as specified above prior to placing the backfill. As determined by the Engineer, pipe that is damaged to such an extent that satisfactory field repairs cannot be made shall be removed and replaced at no additional cost to the Contracting Agency.

Municipality	Supplements
SC:	**621.3 INSTALLATION:** *Delete the first sentence and insert the following:* Pipe trenching and bedding shall conform to the requirements of MAG Section 601 as modified by COS Section 601.

621.3.1 Joints: Before the connecting band is placed around the pipe, the ends of the pipe that will be beneath the band, shall be coated with bituminous mastic or, if of suitable design, fitted with circular rubber gaskets to provide a watertight joint. The band shall be tightened evenly, keeping equal tension on the bolts. If mastic is used, tension shall be maintained over an interval of time until the flow of mastic terminates. The joint shall remain uncovered over a period designated by the Engineer, and before covering the joint the nuts shall be tested for tightness. If the nut has a tendency to loosen its grip on the bolt, it shall be tightened again and remain uncovered until a tight, permanent joint can be obtained. Prior to backfilling around the joint, the bolts, lugs, and nuts shall be given a coating of bituminous mastic. The annular space between abutting pipe sections shall be filled with bituminous mastic after jointing.

Municipality	Supplements
SC:	**621.3.1 Joints**: *Add the following:* Metal pipe shall be joined using annular corrugated or hugger type metal bands locking in at least one annular corrugation and shall be installed to form a watertight joint. Annular corrugated bands shall use a 1/4-inch thick rubber sleeve gasket the same width as the band. Hugger type metal bands shall use an "O" ring gasket placed in the first annular corrugation of the pipe. Coupling bands shall conform to COS Subsection 760.4. Coupling bands shall be evenly drawn together by a minimum of two 1/2-inch diameter galvanized bolts through the use of a bar and strap assembly suitably welded to the band. "O" ring gaskets shall be compressed by tightening the coupling band in accordance with the manufacturer's installation instructions. Annular joints on concrete lined pipe shall be mortared to a smooth steel trowel finish. Annular joints in smooth metal lined corrugated metal pipe shall be filled after couplings are secured with an appropriate compound approved by the Engineer. Other methods of joining may be used subject to approval of the Engineer.

621.3.2 Pipe Elongation: Except as otherwise specified, the standard details shall control as to conditions under which pipe must be elongated. Pipe shall be elongated 5 ± 1/2 percent of the nominal diameter to take advantage of the buildup of side support as it settles back toward a full round shape under the backfill load. The method or technique for obtaining and releasing the elongation shall be optional to the Contractor. Under no circumstances shall the vertical diameter of the pipe at any point along the pipe section, after backfill and compaction is completed, be less than the nominal diameter of the pipe, or more than 5 percent greater

than the nominal diameter of the pipe as shown on the plans or specified elsewhere in this specification. Any damage done as a result of strutting shall be repaired as directed by the Engineer at no additional cost to the Contracting Agency. Strutting of pipe shall be approved by the Engineer.

621.3.3 Cutting: The Contractor will be prohibited from using conventional welding torches in cutting full lined CMP due to fire hazard. Pipe will either be sawcut or cut with special cutting tools which will not expose the pipe to the fire hazard of a normal acetylene torch. Whenever possible, connections shall be shop fabricated to prevent any exposure to fire hazard.

621.3.4 Repair of Damage to Coatings: Corrugated metal pipe shall be carefully handled at all times to prevent damage to the external coating, spelter coating, or internal lining. Each length of pipe shall be carefully inspected immediately prior to placing in the trench to ascertain that no damage has been done to the exterior coating that will be concealed when the pipe is placed. Any damage to the spelter coating, shall be repaired to the satisfaction of the Engineer in accordance with Section 771. Any damage to the external coating or internal lining shall be repaired to the satisfaction of the Engineer with bituminous mastic as specified above.

621.4 TEST SPECIMENS:

All tests on the bituminous coating shall be made on samples secured from pipe delivered to or about to be delivered to the Contractor, or from the coating and lining facility of the pipe fabricator at the time the pipe is being coated.

Compliance with these specifications as set forth, shall be the responsibility of the Contractor. Three certified copies of test results indicating compliance shall be furnished for each lot or shipment prior to delivery of the material to the Contractor.

621.5 MEASUREMENT:

Measurement of corrugated metal pipe will be the number of linear feet of pipe, measured horizontally, from end to end of the pipe through manholes and specials. At changes in diameter the measurement will be to center of manhole or special.

621.6 PAYMENT:

Payment will be made at the contract unit price bid per linear foot, to the nearest foot, for each size and type of pipe and shall be compensation in full for furnishing and installing the corrugated metal pipe as specified, including removal of obstructions, excavation, backfilling, compacting, testing, and all incidental costs not specifically covered in other items in the proposal.

Phoenix has added the following:

Municipality	Supplements
PH:	**622.1 HIGH DENSITY POLYETHYLENE PIPE (HDPE)** HDPE pipe is approved for storm drain use in diameters up to and including 48-inches. All HDPE shall be designed and installed in accordance with current standards of AASHTO M252, AASHTO M294, MAG 603, MAG 738 and City of Phoenix Supplements. To MAG. All HDPE storm drain pipe shall be Type "S" corrugated, with watertight joints. HDPE pipe shall not be allowed within a minimum of twenty-four (24) linear feet of an open outfall. The outfall section of storm drain pipe shall be concrete or concrete-lined. At a minimum, all HDPE storm drain pipe joints shall meet the ASTM D-3212 watertight requirement of 10.8 psi (25 column feet of water head). Pipe within the street section shall be installed with a minimum 2.0 feet of cover. The Contractor shall provide a copy of an accepted independent lab certification that the pipe and joints to be used on the projects meet the ASTM D-3212 watertight standard

Municipality	Supplements
PH:	**622.2 LEAKAGE TEST FOR MAINLINE STORM DRAIN PIPE** Both High Density Polyethylene Pipe (HDPE) and Corrugated Steel Pipe (CSP) storm sewer pipelines, except culverts and catch basin connector pipes shall be subjected to a test for leakage conducted in accordance with the following criteria: A. After bedding (1 foot above pipe), the first three (3) joints of mainline pipe shall be tested in accordance with the following procedure: 1. Testing shall be accomplished by plugging the pipe test section and all branch lines and filling the pipe with water. Equipment for the test shall be furnished by the Contractor, and shall include a metal standpipe, a suitable meter or other acceptable method of measuring the quantity of water used. A period of at least one (1) hour shall be allowed for absorption before making the test. 2. The allowable water loss for corrugated steel storm sewers shall not exceed 1.0 gallons per hour per 100-feet of pipe per inch of diameter of pipe under a minimum test head of 4-feet above the top of the pipe at the upper end of the test section. A minimum test time of one (1) hour (60 minutes) shall be required after the initial one (1) hour for absorption. 3. The leakage test shall be made by the Contractor in the presence of the Engineer. B. If the first test exceeds the specified leakage limit, the Contractor shall repair or replace all sections that fail the leakage test. All repaired or replaced pipe sections shall be retested for compliance. 1. The Engineer reserves the right to require additional leakage tests as deemed necessary during the course of construction to ensure that the remainder of the pipeline is leak resistant.

Municipality	Supplements
PH:	**623 SPECIAL BEDDING FOR MAINLINE STORM DRAIN PIPE** The Contractor shall utilize a cement-enriched slurry aggregate base course bedding for all mainline storm drain pipe, except cast-in-place. The slurry aggregate base course shall be per MAG Specification Section 728. The slurry shall be placed at a minimum from the outside bottom of the pipe to the springline of the pipe. The slurry shall have a minimum 8-inch slump, and a minimum of 25 psi compressive strength and a maximum of 100 psi based on a 28 day test. Slurry aggregate base course bedding is not required for catch basin connector pipes. The Contractor, at his option, may excavate a trench having a cross-section with a rounded bottom rather than a flat bottom. If this option is chosen, the trench cross-section must maintain a minimum of 6-inches between the outside wall of the pipe and the trench wall. The minimum trench width at the springline for each side of the pipe, as specified in Section 601, may be reduced to 6-inches for all pipe sizes if this option is used. The Contractor, at his option, may use slurry aggregate base course or the bedding material specified in the City of Phoenix Supplement to MAG Section 601.4.2 from the springline to one (1) foot over the outside top of pipe. If the Contractor elects to use slurry from the springline to one (1) foot over the outside top of corrugated steel or ***high density polyethylene*** storm drain pipe, the leakage test will not be required.

Municipality	Supplements
PH:	**624 CONNECTING EXTENSIONS TO MAINLINE STORM DRAINS** Prior to extending any existing mainline storm drain, the Contractor shall verify the depth, size, pipe type, and horizontal location of the existing storm drain in the field. If the new pipe extension is the same type and size as the existing, or if the pipe manufacturer makes a standard watertight adapter fitting made specifically to join with the existing pipe type, a standard manufacturer recommended connection may be used. Otherwise, a concrete field collar in accordance with MAG Standard Detail 505 shall be used.

MANHOLE CONSTRUCTION AND DROP SEWER CONNECTIONS

625.1 DESCRIPTION:

625.1.1 Sewer Manholes: Construction shall consist of furnishing all materials and constructing manholes complete in place, as detailed, including foundation walls, cast iron steps, manhole frames, covers, and any incidentals thereto, at locations shown on the plans.

Municipality	Supplements
PH:	**625.1.1 Description** Scope: this section specifies the lining of sanitary sewer manholes to provide protection against corrosion of the manhole interior and sewer located below the manhole. A. Requirements 1. Contractors shall furnish all labor, materials, and equipment required to clean and line the manholes. 2. Contractor shall comply with the local authority and all occupation safety and health administration (OSHA) requirements for confined space entry. 3. All materials specified by name brand or manufacturer shall be delivered unopened to the job in original containers. 4. All Safety precautions recommended by the manufacturer in printed instructions or special bulletins shall be obtained and followed. The work shall be carried out after the sewer is installed

625.1.2 Drop Sewer Connections: Construction shall consist of furnishing all materials and constructing drop sewer connections complete in place as detailed, including foundation materials, pipe, and any incidentals thereto, at locations shown on the plans.

Municipality	Supplements
PH:	**625.1.2 Quality Assurance.** A. Standardization: Materials and supplies provided shall be the standard products of manufacturers. The standard products of manufacturers other than those specified will be accepted when it is demonstrated to the Engineer that they are equal in composition, durability, and usefulness for the purpose intended. Requests for submission shall include directions for the application, descriptive literature, safe storage, handling, and disposal of the product. B. Bonded Warranty: The coating applicator shall supply a five-year bond, payable to the City of Phoenix (COP), for the coating that is approved by the COP. The five-year bond shall cover both the material costs and the labor costs associated with installing the approved coating. The bond shall also be unconditional in nature covering any type of failure in the coating and agreeing to repair or replace it at no cost to the COP at any point during this five-year period. The coating applicator shall also supply a warranty from the coating manufacturer addressed to the bonding company and the COP. This warranty shall state, at a minimum, if the coating is applied in accordance with the manufacturer's instruction, the coating will not fail for a period of five-years. The definition of a coating failure is blistering, cracking, embrittlement, or softening of the coating is starting to occur.

Municipality	Supplements
SC:	**625.1.2 Drop Sewer Manholes:** ***Add the following sentence:*** For installations of MAG Standard Detail No. 426, Type A, change 2.5 feet minimum to read 1.5 feet minimum

Phoenix Adds the Following:

Municipality	Supplements
PH:	**625.1.3 Submittals** A. Contractor Shall Submit: 1. Manufacturer's Data a) Manufacturer's technical literature on coating material. b) Description of installation method including: I. Product material safety data sheets (MSDSI). II. Maximum storage life and storage requirements. III. Mixing and proportioning requirements (as applicable). IV. Environmental requirements for application and worker safety, including ventilation, humidity, and temperature ranges. V. Application film thickness PM coat of primer and finish coat. VI. Curing time required. 2. Sample of finished product showing final color. Lining color shall be white. Part 2 Products **625.1.4 Coating Material** A. Approved Materials: Coating materials shall be one of the following pre-approved types or an approved material equal to or better: 1. Sauereisen corrosion-clad polymer lining No. 210, Sauereisen underlayment. 2. No. F-120, as manufactured by Sauereisen Cements, Pittsburgh, PA 15238. The underlayment shall be used to repair the cleaned surfaces in accordance with the manufacturer's recommendations. The number 210 lining shall be applied to a minimum thickness of 1/8-inch (125 Mills) according to the manufactures recommended procedures. 3. Sewer shield 101A topcoat with C120 calcium aluminate cement underlayment as manufactured by Environmental Coating, Mesa, AZ 85207. The C120 Calcium Aluminate cement shall be trowel applied to repair the cleaned surfaces in accordance with the manufacturer's recommendations. The sewer shield 101A topcoat shall be spray applied to a minimum thickness of 1/8 inch according to the manufacturer's recommended procedures.

Municipality	Supplements
PH:	**625.1.5 Product Data** The Contractor shall provide the following information: 1. Manufacturer certification of applicators used for the coating installation work, including spray operators as applicable. 2. Samples of coating and color chart. Coating applicator shall be an Arizona licensed Contractor

Part 3. Execution

Municipality	Supplements
PH:	**625.1.6 Manhole Cleaning** a) Cleaning shall remove all sediment, rocks, debris, roots, grease accumulations, and obstructions from the manholes. Cleaning of the manhole walls, bench, and channel shall remove all grease, scale encrustation, and loose mortar so that no foreign intrusion shall cause imperfections in the coating. Cleaning methods shall include washing with high-pressure water, mechanical removal, or other as approved by the Engineer. b) The Contractor shall use water blasting with a minimum water pressure of 3,000 PSI to clean the manhole prior to applying the coating. Contractor shall also be responsible for any additional surface preparation beyond water blasting as required by the coating system manufacturer. Where additional preparation is required, the Contractor shall provide all labor materials and equipment as necessary at no additional cost to the City. c) Before installation of the coating system, the surface must be clean. Excess water shall be blown from the surface using compressed air equipment with oil-trapping filters. Suitable heaters shall be used as needed to produce a surface-dry condition. The surface shall be vacuumed to make sure that loose particles are not present. d) Any sediment or debris from cleaning operations larger than U.S. #8 sieve shall not be deposited downstream in the sewer. Sedimentation deposited downstream, as determined by the Engineer, shall be removed at no cost to the City.

Municipality	Supplements
PH:	**625.1.7 Inspection and Testing** A. Contractor shall give Engineer a minimum of three days advance notice on start of field surface preparation work or coating application work, and a minimum of seven days advance notice start on any shop surface preparation work. **B.** All work shall be performed in presence of Engineer, unless Engineer has granted prior approval to perform work in absence. **The Contractor shall provide testing performed by an independent Special Inspection Testing Agency or Laboratory approved by the City of Phoenix. Cost of this special inspection and testing shall be the responsibility of the Contractor.** C. Inspection by Engineer or waiver of inspection in any particular portion of work shall not relieve Contractor of responsibility to perform work in accordance with Specification. D. Scaffolding shall be erected and moved to locations to facilitate inspection by Engineer. Additional illumination shall be furnished when Engineer requests. E. Contractor shall furnish (until final acceptance of coatings) inspection devices in good working condition for detection of holidays and measurement of wet and dry-film thickness of protective coatings. Wet and dry-film thickness gauges shall be available for Engineer's use until acceptance of coating process is complete and final acceptance of coatings made. Contractor shall furnish services of trained operator in holiday detection devices until final acceptance of coatings. Holiday detection devices shall be operated in presence of Engineer. F. Contractor shall holiday test in presence of Engineer all coated surfaces. Holiday testing equipment and procedures shall be performed in strict accordance with latest edition of NACE "Standard Recommended Practice-Discontinuity (Holiday) Testing of Protective Coatings." Areas containing holidays shall be marked repaired or re-coated and re-tested in accordance with coating manufacturer's printed instructions. Holiday detectors shall be:

1. High voltage pulse-type holiday detectors as manufactured by Tinker & Rasor or D.E. Stearns Co. Unit shall be adjusted to operate at voltage required to cause sparks jump across air gap equal to twice specified coating thickness.

G. Wet film thickness measurement shall be supplemented by report submitted by Contractor or Engineer. The report shall be presented after completion of underlayment, top coating operations, and shall state number of manufacturer's product units used and total square footage of surface area covered. Engineer shall have option of requiring Contractor to document number of units (coating materials) on hand before and after coating operations to verify actual minimum dry film thickness applied.

All film thicknesses not meeting required minimums will be re-coated per manufacturer's recommendations.

H. SANITARY SEWER MANHOLE TESTING

All new sanitary sewer manholes installed shall be tested for exfiltration either by a watertightness test or by a negative air pressure (vacuum) test. Exfiltration testing shall be performed in accordance with MAG Section 615.10(B) and Arizona Department of Environmental Quality (ADEQ) Engineering Bulletin No. 11, Chapter 4, Section B.

When using the watertightness test method, exfiltration loss shall not exceed 0.1 gallons per vertical foot of manhole in a 24-hour period.

Negative air pressure (vacuum) testing shall be performed in accordance with ASTM C 1244. Testing shall be performed at the top of the manhole cone for manholes located in paved areas. Manholes outside paved areas shall be vacuum tested at the ring and cover. A negative air pressure of ten (10) inches of mercury shall be drawn on the manhole. The time shall be measured for the vacuum to drop from ten (10) inches to nine (9) inches of mercury. The manhole shall pass this test if the time to drop in mercury meets or exceeds the following values:

MANHOLE DEPTH	MINIMUM TEST DURATION (SECS) 48-INCH DIAMETER MANHOLE	MINIMUM TEST DURATION (SECS) 60-INCH DIAMETER MANHOLE
10 feet or less	60	75
Greater than 10 feet to 15 feet	Not Applicable*	90
Greater than 15 feet	Not Applicable*	105

*Manholes greater than 13 feet in height shall be 60-inch diameter

If manhole joint compound is pulled out during the vacuum test, the manhole shall be disassembled and the joint repaired or replaced as necessary. The vacuum testing shall then be repeated until the manhole passes.

Exfiltration testing of sanitary sewer manholes is considered incidental to the cost of furnishing and installing the manhole. There will be no separate measurement or payment for this testing.

Municipality	**Supplements**
PH:	**625.1.8 Correction Period Inspection** A. Inspection shall be conducted during eleventh month following completion of all coating work. Contractor and representative of coating manufacturer shall attend inspection. Defective work shall be repaired in accordance with specifications and satisfaction of Owner. Owner may, by written notice to Contractor, reschedule warranty inspection to another date within one-year correction period, or may cancel warranty inspection altogether. If warranty inspection is not held, Contractor is not relieved of responsibilities under Contract Documents.

625.2 MATERIALS:

Unless otherwise shown on the plans or specified in the special provisions, materials to be used shall conform with the following:

Bricks for manholes Section 775.

Cement mortar for manholes Class D, Section 776.

Concrete for manholes Class A, for drop sewer connection Class C, Section 725.

Pipe used in manholes or drop sewer connections shall comply with pipe requirements of Section 615.

Manhole frame, cover and steps Section 787 and cast in accordance with standard details.

Plastic manhole steps, which conform to O.S.H.A. and A.S.T.M. C-487 requirements, and steel manhole steps, which are completely encapsulated in corrosion resistant rubber and conform to O.S.H.A. and A.S.T.M. C-478 requirements, may be substituted for cast iron manhole steps. The manufacturer shall furnish the Engineer a certification indicating conformance.

Municipality	Supplements
PH:	**Subsection 625.2 Materials:** Add the following paragraph: Plastic manhole steps that mechanically lock into precast holes in the manhole structure are accepted for use. Plastic shall conform to ASTM D-2146, TYPE II.

Municipality	Supplements
SC:	**625.2* Materials:** Add n*ew section.* Plastic sheet liner shall be "Amer-Plate T-Lock" by Americoat Corporation or approved equal. Epoxy Coatings shall be Sauereisen "SewerGard No. 210", Somay "Plasite 5371", Raven "404" or approved equal.

625.3 CONSTRUCTION METHODS:

625.3.1 Manholes: Manholes shall be constructed of brick, of precast concrete sections, or of cast in place concrete with cast iron manhole steps, frames and covers, in accordance with the standard details. The invert channels shall be smooth and semi-circular in shape, conforming to the inside of the adjacent sewer sections. Changes in direction of flow shall be made with a smooth curve, having a radius as large as the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly.

Invert channels may be formed of concrete or brick masonry having a smooth plastered surface, may be half tile laid in concrete or brick, or may be constructed by laying full section of sewer pipe through the manhole and breaking out the top half after the surrounding concrete or brick masonry has hardened. The floor of the manhole outside the channels shall be smoothed and shall slope towards the channels.

The excavation shall be made cylindrical to a diameter sufficient in size to permit sheeting if necessary and leave room that the bricks may be laid in a workmanlike manner and the outside plaster coat properly applied or the precast concrete sections or forms may be properly assembled.

A concrete foundation of Class A concrete shall be poured in accordance with the Standard Details and Section 505.

Brickwork shall not be laid upon a concrete foundation less than 24 hours after such foundation has been poured. No brickwork shall be laid in water, nor, except as prescribed for curing, shall water be allowed to stand or run on any brickwork until the mortar has thoroughly set. Where new work is joined to existing unfinished work, the contact surfaces of the latter shall be thoroughly cleaned and moistened.

Bricks shall be thoroughly moistened prior to placing, and shall be laid in full cement mortar beds. Every course may be a header course, but at least every fourth course shall be a header course. The horizontal cross section of the manhole shall be circular unless otherwise called for on the plans or standard details. An oval or egg-shaped section will not be permitted. A double row-lock course of brick in the manhole wall shall be arched over the top half of the circumference of all inlet and outlet pipes. The brick manholes shall be plastered outside with 1/2 inch of cement mortar as shown on the standard details. Inside of brick wall shall be neatly pointed. The plaster coat shall be cured with a liquid membrane-forming compound conforming with Section 726 immediately after plaster has been placed and finished.

Frame and Cover. All machined surfaces on the frame and cover shall be such that the cover will lie flat in any position in the frame and have a uniform bearing through its entire circumference. Any frame and cover which creates any noise when passed over by automobiles shall be replaced. Frames shall be set firmly in a bed of mortar true to line and grade, all as shown on the plans and as called for in these specifications.

Backfilling shall be done in accordance with the requirements for trench backfilling as stated in Section 601.

Municipality	**Supplements**
ME:	Y. Section 625.31 – Add the following paragraph to this Section: All manholes shall have a minimum of 6-inches and maximum of 16-inches of reinforced concrete adjusting rings. All joints between shaft sections, cones and adjustment rings shall be sealed with "RAM NEK" plastic gasket, mortar, or approved equal. When a manhole is called out in the plans or in the specification to be lined with a PVC T-lock lining, all exposed concrete surfaces including the shelf and opening shall be lined. When manholes are placed within asphalt paved areas, the rings and covers shall be installed per M.A.G. Standard Detail 422

Municipality	**Supplements**
SC:	**625.3.1 Manholes:** *Add the following paragraphs:* Sections of pipe connected to manholes shall be no longer than five (5) feet to minimize adverse impacts to the sewer line due to settlement of the manhole. When concrete adjustment rings are used for sewer manhole installations, the rings must be sealed on the inside using grout, "Ram-Nec", or approved equal. Manholes outside of vehicle travel lanes shall be adjusted to 1-1/2 inches above finished grade. All manholes shall have a concrete collar around the ring and cover per COS Standard Detail No. 2270. All manhole barrels will be sealed at the base with "Ram-Nec" or approved equal. Approved water stop ring for manhole base penetrations is "Adeka" MC-2005T for pipe diameters 24 inches or less and "Adeka" MC-2010M for pipe diameters greater than 24 inches, or approved equal. * Epoxy Coatings: 100% solids monolithic coating systems shall be trowel applied per the manufacturer's instructions. Coatings for bases shall have a non-skid surface. Surfaces to be Epoxy coated shall cure for a minimum of 28 days and shall not have received any type of curing agent or sealer. Remove all oil, grease, foreign contaminants and loose laitance prior to the application of the epoxy coating. Sandblasting with fine silica sand to a desired texture equivalent to 40 to 60 grit sandpaper insuring the removal of any and all glaze is required. Hydro blasting is acceptable if first approved by the City Inspector.

625.3.2 Drop Sewer Connections: Drop sewer connections shall be constructed in conformance with standard details, as the case may be.

Backfilling shall be done in accordance with the requirements for trench backfilling as stated in Section 601.

Scottsdale Adds the Following:

Municipality	Supplements
SC:	**625.3.3 Manhole Testing:** All manholes installed shall be tested by exfiltration testing or by vacuum testing. Exfiltration testing shall be performed in accordance with MAG Section 615.10(B) and Arizona Department of Environmental Quality (ADEQ) Engineering Bulletin No. 11, Chapter 4, Section B. Exfiltration from manholes shall be limited to 0.1 gallons per hour per vertical foot. Manholes shall be exfiltrated tested for a period of 24 hours. Vacuum testing shall be performed in accordance with ASTM C 1244. Vacuum testing shall be performed at the top of the manhole cone for manholes located in of paved areas. Manholes outside of paved areas shall be vacuum tested at the ring and cover. A vacuum of 10 inches of mercury negative pressure shall be drawn on the manhole. The time shall be measured for the vacuum to drop to 9 inches of mercury negative pressure. The manhole shall pass the vacuum test if the time for the vacuum reading to from 10 inches of mercury negative pressure meets or exceeds the following values.

Manhole Depth	Minimum Test Duration (Seconds) - 48" Diameter Manhole	Minimum Test Duration (Seconds) - 60" Diameter Manhole
10 ft. or less	60	75
Greater than 10 ft. to 15 ft.	N/A	90
Greater than 15 ft.	N/A	105

N/A = Not applicable (manholes greater than 10 feet deep shall be 60" diameter).

If manhole joint compound is pulled out during the vacuum test, the manhole shall be disassembled and the joint repaired or replaced, as necessary. The vacuum test shall then be repeated until the manhole passed the test or the manhole is tested and passes the standard exfiltration referenced above.

Testing of sanitary sewer manholes is considered incidental to the price bid for manhole installation and no additional payment shall be made.

Municipality	Supplements
SC:	**625.3.4 Monitoring Manholes:** The city shall determine whether or not a sewer user will be required to have a monitoring manhole to test the flow and composition of their sewage. Sewer users with a USEPA Categorical Standard, a sewer discharge of 25,000 gallons per day of process wastewater, or any user that has the potential to discharge a pollutant as determined by the City's Water Quality Division of the Water Resources Department, shall be required to have a monitoring manhole. Flows of less than 25,000 gpd shall require a City of Scottsdale monitoring/sampling manhole MAG Detail # 420 with a straight channel and no taps or bends for (10') ten feet upstream and downstream of the manhole. Flows of 25,000 gpd or more shall require a monitoring vault per City of Scottsdale Supplemental Detail # 2460. Monitoring manholes and vaults shall be located in a twelve (12') foot PUE which extends from the manhole to the existing public sewer. The monitoring manhole shall be accessible at all times for monitoring crews and vehicles

625.4 MEASUREMENT:

Measurement will be per manhole installed, complete in place, regardless of depth.

625.5 PAYMENT:

Payment will be made at the unit price bid each manhole, and shall be compensation in full for furnishing and installing manhole, complete, with formed invert, concrete foundation, ladder rungs, cast iron frame and cover, excavation and backfill, paving cut replacement in excess of the applicable pay widths authorized in Section 336, and any incidentals thereto, in conformance with the plans and specifications.

Payment will be made at the unit price bid each, and shall be compensation in full for furnishing and installing vitrified clay pipe sanitary sewer drop connections, concrete encasement, excavation, backfilling, water settling, compaction, sheeting and bracing, removal of obstructions, paving cut replacement, in excess of the applicable pay widths authorized in Section 336, testing, and all work incidental thereto in conformance with the plans and specifications.

Municipality	**Supplements**
CH:	**SPECIFICATION NO. 2:** **SEWER MANHOLE** 1. **Sewer Manhole:** Precast concrete sewer manholes which are constructed as a separate project prior to surface improvements shall be required to have a minimum of 12 inches and a maximum of 24 inches of reinforced concrete adjusting rings. Manholes constructed in conjunction with, or after roadway paving improvements shall be constructed in accordance with MAG Standard Detail 420. 2. **Trunk Sewer Manhole:** Manholes located in major or minor arterial streets or serving 18 inches in diameter and larger pipe shall have installed 360 degree, white T-lock PVC lining in conformance with MAG Standard Specification 741 and installed per manufacturer's specifications using type P-1 joints. 3. **Pesticide Coating:** Manholes shall be painted with a latex pesticide paint such as Insecta Insecticide Coating, or approved equal. Application rates shall be in accordance with the manufacturer's recommendations. Application shall be in compliance with E.P.A. recommendations and applied starting from the top of the bench to eight feet above the bench. 4. **Testing:** Testing of PVC lining materials shall be accomplished in accordance with MAG Standard Specification 741.

TAPPING SLEEVES, VALVES AND VALVE BOXES ON WATER LINES

630.1 DESCRIPTION:

The installation of all tapping sleeves, valves and valve boxes shall conform to this specification and standard details, except as otherwise required on the plans or as modified in the special provisions.

630.2 GENERAL:

For valves 12 inches and smaller, the Contractor shall furnish the manufacturer's standard data and catalogues for gate valves, tapping valves, tapping sleeves, curb stop valves, butterfly valves and any castings.

For valves larger than 12 inches, the Contractor shall furnish shop drawings and technical data required for evaluating and approval of each type of valve, tapping sleeve and valve and butterfly valve. This information shall include complete details, dimensions, weights, diameter of stems, alloy for all valve parts, and any information that may be required to assemble, install, operate and maintain the valve.

The name of the manufacturer, the year of manufacture, the size of the valve, model number and rated working pressure, shall be cast on the body of each valve.

The Contracting Agency may test 10 percent of each type and size of valve furnished. Failure of any of the valves tested to meet these specifications, shall be deemed sufficient cause to reject the entire lot delivered.

The internal working parts of valves of the same make, type, and size, shall be interchangeable.

630.3 GATE VALVES:

Municipality	Supplements
TE:	SECTION 630.3 All valves over 12" in size shall be butterfly valves

630.3.1 General: All valves shall conform to the latest revisions of AWWA standards supplemented as follows:

Valves shall be of the non-rising stem type and shall be counter-clockwise opening (left-hand). The valve may be furnished with valve stems made from 300 or 400 series stainless steel. Unless otherwise noted, valves shall have a 2 inch square operating nut.

All valves shall be class 150 or higher as necessary to withstand the requirements of the pressure and leakage test.

Bronze for all interior parts of valves shall contain not more than 6 percent zinc if made from cast bronze, or must conform to Copper Development Association #67600 if made from bar stock material.

All interior ferrous surfaces exposed to fluid flow shall be epoxy coated to a minimum dry film thickness of 6 mils. Epoxy coatings shall be factory applied by a electrostatic or thermosetting process in accordance with the manufacturer’s printed instructions. The epoxy materials used shall be 100% powder epoxy or liquid epoxy that conforms to the requirements of AWWA C-550, and to the prevailing requirements of the Food and Drug Administration and of the Environmental Protection Agency.

All exterior ferrous surfaces, except finished or bearing surfaces, shall be factory coated with two coats of asphaltic varnish conforming to Federal Specifications TT-V-51c, or shall be epoxy coated as required above for interior surfaces.

By-pass valves, valves attached to side outlets and valves in blow-off lines shall be flanged.

Valves in air release and vacuum relief lines shall be flanged or screwed as shown on the plans.

Valves in fire hydrant lines shall have a flanged joint end on the side towards the main and a restraint or mechanical joint end on the side towards the hydrant.

Valves larger than 20 inches shall have flanged ends, unless otherwise noted.

Valves 20 inches and smaller may be furnished with flanged ends, mechanical joint ends, or push-on joint ends compatible with the type of pipe used, unless otherwise noted.

CH:	**SPECIFICATION NO. 10** **STANDARDS FOR** **WATER PIPE AND FITTINGS** **4" THROUGH 16" DIAMETER** F. **630.3 GATE VALVES: Subsection (A)** Change the sixth paragraph to read: The connecting ends of valves may be flange, mechanical joint, push-on, or an appropriate combination. Valves which require transition gaskets to ductile iron pipe sizes may be furnished only in sizes 4 inches through 8 inches.

Municipality	Supplements
SC:	**630.3.1 General:** *Add the following sentence to this paragraph:* All gate valves shall be provided with low-zinc stems.

Municipality	Supplements
TE:	SECTION 631.1 All water service connections from the main to the meter shall be constructed of type K copper pipe only. NO polyethylene pipe will be permitted

630.3.2 Supplements Specifically Relating to Valve Sizes:

(A) Valves smaller than 3 inches:

Valves shall be Jones, Ford, Hayes, Mueller or an approved equal, and shall be threaded, all bronze, standard double disc, non-rising stem with wheel handles.

(B) Valves 3 inches through 12 inches:

Valves shall be iron body resilient-seated gate valves in accordance with the latest revision of AWWA C-509 or AWWA C-515.

The valve shall be designed to work equally well with pressure on either side of the gate.

The valve shall be equipped with o-ring packing.

(C) Valves. 14 inches through 20 inches:

Valves shall be iron body resilient-seated gate valves in accordance with the latest revision of AWWA C-509 or AWWA C-515, or shall be double-disc gate in accordance with AWWA C-500.

Valves designed in accordance with AWWA C-509 shall be designed to work equally well with pressure on either side of the gate

Valves designed in accordance with AWWA C-500 shall be equipped with bronze tracks, rollers and scrapers. The bolts, nuts, studs, etc., used with the gear case shall conform the requirements for Bonnet Bolting in AWWA C-500.

Valves shall be for operation in a horizontal position. The valve shall have bevel gears. The gears and stuffing box shall be enclosed in a watertight iron case, for operation in a buried location. The case shall be filled with grease at the factory.

By-pass valves shall be furnished and installed on each valve unless otherwise indicated on the approved plans. See Table 630-1 for by-pass valve sizes.

(D) Valves 24 inches and larger:

Valves shall be double-disc gate in accordance with AWWA C-500.

Valves shall be for operation in the horizontal position and equipped with bronze tracks, rollers and scrapers. Valves shall have bevel gears. The gears and stuffing box shall be enclosed in a watertight iron case, for operation in a buried location. Bolts, nuts, studs, etc., used with the gear case shall conform to the requirements for Bonnet Bolting in AWWA C-500. The case shall be filled with grease to the factory.

By-pass valves shall be furnished and installed on each valve unless otherwise indicated on the approved plans. See Table 630-1 for by-pass valve sizes.

630.4 TAPPING SLEEVES AND VALVES:

Municipality	**Supplements**
PH:	Subsection 630.4 (B) (2) Stainless Steel Type 304, Change the Subsection to read: Stainless Steel, Type 304 - All integral metal parts of the sleeve shall be stainless steel, Type 304. All welds shall be chemically treated and the residue removed so as to return the welded stainless steel to its original corrosion resistant state. All gaskets shall be of virgin styrene butadiene rubber (SBR), or equal, compounded for water service. The complete circle gasket shall be a minimum of 0.22 inch thick and permanently attached to sleeve. The sleeve shall be capable of withstanding 125 ft.-lbs. of bolting torque without deformation of any sleeve components. Actual bolting torque during installation shall be as specified by the manufacturer.

Municipality	**Supplements**
PH:	Subsection 630.4 (B) (2) Stainless Steel Type 304, Change the Subsection to read: Stainless Steel, Type 304 - All integral metal parts of the sleeve shall be stainless steel, Type 304. All welds shall be chemically treated and the residue removed so as to return the welded stainless steel to its original corrosion resistant state. All gaskets shall be of virgin styrene butadiene rubber (SBR), or equal, compounded for water service. The complete circle gasket shall be a minimum of 0.22 inch thick and permanently attached to sleeve. The sleeve shall be capable of withstanding 125 ft.-lbs. of bolting torque without deformation of any sleeve components. Actual bolting torque during installation shall be as specified by the manufacturer.

630.4.1 Tapping Valves: Tapping valves shall be identical in construction with the above specifications for gate valves. Tapping sleeves are considered an integral part of a tapping sleeve and valve assembly, with openings the same as the valve. Tapping valves shall have ends and seat rings of sufficient size to permit the use of full size cutters of either the Mueller or Smith type tapping machines. Tapping sleeve valves shall be flanged on one end to fit the tapping sleeve and a flange hub-end or mechanical joint on the other.

The tapping valve shall have the discs and seat ring so constructed that the inside diameter of the rings shall be at least 3/16 inch larger than the nominal size of the valve. The seat rings shall be bronze and shall have a minimum seating surface area equal to that of a standard gate valve, and the discs shall be proportionately larger to match.

Once the tap has been completed, the Contractor shall not operate the valve unless under direct supervision of the inspector.

TABLE 630-1	
BY-PASS VALVE SIZES	
Gate Valve Diameter in Inches	**By-Pass Valve Diameter in Inches**
16 to 20	3
24 to 30	4
36 to 42	6
48	8

630.4.2 Tapping Sleeves: Tapping sleeves shall be of extra heavy construction to provide resistance to line pressures. They shall be built in two halves for assembly around the main to be tapped.

The branch outlet shall have a flanged face for bolting to the tapping valve.

The inside diameter of the outlet branch shall be sufficiently larger than the nominal size to provide clearance for the full size cutters of the tapping machine.

Tapping sleeves shall be of the following types:

(A) Tapping sleeves for pipelines constructed of cast iron, ductile iron or asbestos cement:

Unless otherwise noted, the tapping sleeve assembly shall be pressure tested to 200 psi for a minimum of 30 minutes. The pressure test shall occur prior to tapping the main.

(1) Tapping sleeves in which the water is allowed to circulate between the sleeve and the outside surface shall comply to the following:

Gaskets of approved material shall be provided to form watertight joints along the entire length of the sleeve. The circumferential joints at the ends of the run of these sleeves shall be sealed by mechanical joints. Mechanical joints shall conform to the requirements set forth in AWWA C-111 as to dimensions, clearance, materials, etc. except the gaskets and glands for mechanical joints shall be in two pieces.

The longitudinal gaskets shall be totally confined or compressed between ridges and/or grooves extending continuously for the full length of both halves of the sleeve casting. Bolts shall be located close to the outside of the gaskets and closely spaced so as to exert sufficient pressure to form a watertight joint and to amply take care of any design stresses.

(2) Tapping sleeves in which the water is confined to the immediate area of the tap opening may be either of the following:

(a) Cast Iron - The outlet half of each sleeve shall be fitted with a continuous gasket of approximately circular cross section permanently cemented into a groove surrounding the outlet opening. The back half of each sleeve shall be fitted with elastomeric pads, a metal shoe, or other device for developing adequate pressure on the gasket to prevent leakage at any pressure within the design capacity of the pipe. The sleeve shall be similar in construction to the Kennedy Square Seal or Rich-Corey improved sleeve.

(b) Stainless Steel, Type 304 - All integral metal parts of the sleeve shall be stainless steel, type 304. All welds shall be chemically treated and the residue removed so as to return the welded stainless steel to its original corrosion resistant state. The sleeve shall be capable of withstanding 125 ft.-lbs. of bolting torque without deformation of any sleeve components. Actual bolting torque during installation shall be as specified by the manufacturer.

All gaskets shall be of virgin styrene butadiene rubber (SBR), or equal, compound for water services. The complete circle gasket shall be 0.25 inch ±0.03 thick and permanently attached to the sleeve. A dielectric insulating flange insulation kit shall be installed between the stainless steel flange and the cast iron valve. The kit shall contain full faced gaskets, full length sleeves, and single insulating washers. Insulation gasket material shall be neoprene-faced phenolic, insulation sleeves shall be mylar or minlon and full length, insulation washers shall be phenolic, or approved equal. All insulation material shall be of a type designated by the manufacturer as suitable for service at the operation temperatures and pressure specified.

(B) Tapping sleeves for concrete pressure pipes shall be fabricated tapping sleeves and comply to the following.

The sleeves shall be installed in accordance with AWWA Manual M-9. They shall also meet AWWA C-301, and AWWA C-303 standards pertaining to design, manufacturing, testing and welder qualifications. When tapping AWWA C-301 pipe, additional considerations pertaining to installation, testing and tapping shall be noted in the special prevision and/or the plans.

The tapping sleeve assembly shall be designed to meet or exceed the pressure rating of the pipe using the same safety factors.

The tapping sleeve assembly shall be pressure tested to at least 5 percent over the actual working pressure in the pipeline. The main shall be pressurized to full working pressure during the test of the sleeve. The test shall occur prior to tapping of the main.

The sleeve shall be a three part design, back half, front half with draw flange and a gland as shown in Detail 342. The sleeve shall be designed to permit the cutting of the of the rods or prestressing wires of the pipe after installation of the two sleeve halves. The gland shall have a sealing gasket set in a retaining groove on the pressure plate. The sealing portion of the gasket shall be square or rectangular in shape and have minimum dimensions of 1/2 inch x 1/2 inch. The pressure plate on the gland shall be stabilized to eliminate flexing. The gland shall be equipped with load bearing set screws to protect the pipe cylinder from any excess loading caused by the valve, tapping machine, etc. The annular space between the sleeve and the gland shall be grouted through an opening in the sleeve.

Both halves of the sleeve shall be the same thickness and width. With approval from the Engineer, stainless steel strapped back sleeves will be permitted when the outside pipe diameter is irregular and can not accommodate a full back sleeve.

The sleeves shall be furnished with grout horns/openings through which the annular space between the outside pipe surface and the sleeve shall be grouted.

All interior and exterior ferrous surfaces shall be epoxy coated to a minimum dry film thickness of 12 mils. Epoxy coating shall be factory applied by a electrostatic or thermosetting process in accordance with the manufactures's instructions. The epoxy materials used shall be 100% powder epoxy or liquid epoxy that conforms to the requirements of AWWA C-550 for use in a potable water system.

All bolts shall be 304 stainless steel.

No weld-on sleeves or nozzles will be permitted.

Tapping sleeves shall be JCM #415 Type 2 ESS or approved equal.

All external surfaces of the tapping sleeve shall be covered with a minimum of two inches of mortar. The mortar shall be Type "M" per Section 776 using Type II low alkali cement. The mortar shall be held in place by use of wire mesh.

The Contractor shall obtain the necessary dimensions for ordering the sleeve from direct field measurements. Excavation may be required to obtain the measurements. If an excavation is required, the Engineer may require the Contractor to return the land to its original use until the materials are delivered.

The contractor shall provide, for approval of the Engineer, the manufacture, shop drawings, calculations, and any other technical data as required by the Engineer for the tapping sleeve. Also, the contractor shall submit the manufacture history of 6 successful production of the sleeves over the last year. The submittal shall include but not limited to the number, size, location, agency and contact person, etc.

The Contractor shall also provide, for approval by the Engineer, the name of the company/contractor/subcontractor to install the sleeve and perform the tap. The submittal shall include a history of 5 successful sleeve installations and taps per year over the last 3 years. The submittal shall include but not limited to the sizes and locations of the taps, the agencies and contact persons, the addresses and telephone numbers, etc.

CH:	**SPECIFICATION NO. 10** **STANDARDS FOR** **WATER PIPE AND FITTINGS** **4" THROUGH 16" DIAMETER** G. **630.4.2 TAPPING SLEEVES AND VALVES: Subsection (A) (2) (a)** Following the word CAST-IRON, add (Not allowed for use on PVC pipe).

Municipality	Supplements
SC:	**630.4.2 TAPPING SLEEVES:** *Add the following paragraph (C):* (C) Ties into existing PVC water mains shall be accomplished by installing a stainless steel tapping sleeve and valve. Cast iron tees may be used with City approval. Stainless steel tapping sleeves shall be 360 degree, full circle tapping sleeves and shall conform to the following specifications: (1) Body - Stainless Steel Type 304, 14 gauge. (2) Flanged Outlet - Stainless Steel Type 304 pipe or tube, Schedule 10 AWWA C-207, Class D, ANSI 150 PSI drilling recessed for tapping. (3) Gasket - 1/4 inch thick, ± 0.03 inch, permanently attached to sleeve. (4) Test Plug - 3/4 inch, 304 Stainless Steel or Bronze. (5) Nuts & Bolts - Stainless Steel 18-8, type 304, Minimum 4 Bolt Pattern Required. Installation of Kennedy Square Seal and Rich Corey tapping sleeves is prohibited on City of Scottsdale water lines.

630.4.3 Tapping and Associated Fees: Except for meter service connections, taps shall be made by the Agency at prevailing rates or by approved Contractors when allowed or requested by the Contracting Agency. After installation of the tapping sleeve and valve, the Contractor shall provide an excavation sufficient in size to accommodate the tapping operation.

The Contractor shall pay the established shutdown charge to the Contracting Agency every time it is necessary to shut off valves and take a section of a water main out of services.

The above charges, as well as charges for tap connections to steel cylinder and reinforced concrete pipe, are subject to change, as established by the Contracting Agency.

630.5 BUTTERFLY VALVES:

(A) 16 inches and larger:

Valves shall be in accordance with AWWA C-504 latest revision as modified herein:

(1) Valve body shall be of cast iron or ductile iron with connecting ends one of or a combination of Flanged (Short Body), mechanical joint or ACP Hub End.

(2) Valves shall be Class 150-B unless otherwise specified.

(3) When requested the manufacturer shall furnish records of tests specified in AWWA C-504.

(4) Shaft seal may be O-ring seal, V-type packing or pull down packing.

(5) The valve disc may be either cast iron or ductile iron.

(6) Valves and operators shall be for direct burial installation.

(7) Valves to be furnished with manual operators and 2 inch square operating nut. Operator torque rating shall be calculated in accordance with AWWA C-504.

(8) Valves shall open when turning the operating nut counter-clockwise.

(9) Valves shall be installed with valve shaft in a horizontal position and the operating shaft vertical.

(10) All interior ferrous surfaces exposed to fluid flow shall be epoxy coated to a minimum dry film thickness of 6 mils. Epoxy coatings shall be factory applied by an electrostatic or thermosetting process in accordance with the manufacturer's printed instructions. The epoxy materials used shall be 100% powder epoxy or liquid epoxy that conforms to the requirements of AWWA C-550, and to the prevailing requirements of the Food and Drug Administration and of the Environmental Protection Agency.

(11) All exterior ferrous surfaces, except finished or bearing surfaces, shall be factory coated with two coats of asphaltic varnish conforming to Federal Specification TT-V-51c, or shall be epoxy coated as required above for interior surfaces.

(12) A manufacturer's affidavit of compliance shall be furnished.

(13) Shop drawings shall be furnished.

(B) 3 inches through 12 inches:

This specification generally describes valves and operator assemblies designed for underground service, as manufactured by Dresser Industries, B-I-F Industries Incorporated, Henry Pratt Company, Allis Chalmers Manufacturing Company, or approved equal.

Where material or equipment is designated on the plans or in this specification by a trade or manufacturer's name, it is so designated primarily to establish standards of quality, finish, appearance and performance.

All specific requirements of this specification must be adhered to, and all necessary modifications shall be made in the article specified by the trade name, type or model or manufacturer's equipment to make it conform to all specific requirements of this specification.

The valves shall be in accordance with AWWA C-504, Class 150-B, except as modified herein:

(1) Valve ends may be the thin type or wafer type to be installed between flanges drilled in conformance with ASA B 16.1-125 or may be flanged both ends or the valves may have bell ends with rubber gaskets, for cast iron pipe or asbestos cement pipe conforming to the kind of pipe being used.

(2) Valves shall be designed for buried service with the valve shaft in a horizontal position and the operating shaft vertical.

(3) Valves shall be left-hand opening, counter-clockwise unless shown otherwise on the plans.

(4) Discs shall be Ni-Resist, ASTM A-436, Type 1, or cast iron, ASTM A-48, Class 40, in accordance with the following variations:

(a) Cast iron disc may be used providing the rubber seat ring is contained on the disc with the rubber ring closing against a Type 304 stainless steel ring or a bronze ring contained in the body of the valve.

(b) Ni-Resist disc may be used where rubber seat is contained in the valve body.

(c) Valves with rubber seats in the valve body may have cast iron discs with a Type 304 stainless steel or bronze edge seating surface retained on the edge of the disc.

Shafts and disc shaft fasteners shall be constructed of Type 304, stainless steel, unless the shaft is completely sealed from the line fluid. Valve shafts completely sealed from the line fluid may be of high strength steel with all other metal parts in contact with the line fluid to be Type 304 stainless steel.

Valves with rubber seat mounted in the body shall have the rubber either bonded or mechanically retained in its final position. Rubber seats which are on the disc edge shall be retained by a clamping ring and screws. Clamping ring and screws shall be made of 18-8 stainless steel, Type 304, or bronze conforming to ASTM B-61 or ASTM B-584.

Manual operators shall have AWWA 2 inch square operating nuts and shall require at least 2 turns per inch diameter to rotate the disc 90 degrees. Operators must accept a minimum of 300 ft. lbs. input torque on stops at ends of travel without damage to valve or operator. The operator torque rating shall equal, or exceed, the valves shown in Table I of AWWA C-504 for valve class specified above.

All interior ferrous surfaces exposed to fluid flow shall be epoxy coated to a minimum dry film thickness of 6 mils.

Epoxy coatings shall be factory applied by an electrostatic or thermosetting process in accordance with the manufacturer's printed instructions.

The epoxy materials used shall be 100% powder epoxy or liquid epoxy that conforms to the requirements AWWA C550-81, and to the prevailing requirements of the Food and Drug Administration and of the Environmental Protection Agency.

All exterior ferrous surfaces, except finished or bearing surfaces, shall be factory coated with 2 coats of asphaltic varnish conforming to Federal Specification TT-V-51c, or shall be epoxy coated as required above for interior surfaces.

CH:	**SPECIFICATION NO. 10** **STANDARDS FOR** **WATER PIPE AND FITTINGS** **4" THROUGH 16" DIAMETER** **630.5 BUTTERFLY VALVES: Subsection (B)** Fourth paragraph, change (1) to read: "(1) Valve ends may be the thin type or wafer type to be installed between the flanges and drilled in conformance with the ASA B 16.1-25, or may have flanges at both ends, or the valves may have bell ends with the rubber gaskets which conform to the type of pipe being used."

Municipality	**Supplements**
PH:	**Subsection 630.5 BUTTERFLY VALVE: (A) 16 INCHES AND LARGER:** add the following: (14) The rubber valve seats shall be located in the valve body for valves 16-inches in diameter and larger. Valve seat configurations which rely on the mating pipe flange to hold the seat in position in the valve body will not be acceptable. The seating surfaces mating with rubber seats shall be AISI Type 304 or 316 stainless steel, monel or plasma-applied nickel-chrome overlay for all valves. (15) Valve shafts shall be fabricated of AISI Type 304 or 316 stainless steel. The use of shafts with a hexagonal cross section is not acceptable. The connection between the shaft and the disc shall be mechanically secured by means of a solid, smooth sided, stainless steel or monel taper pin or dowel pin. Each taper pin or dowel pin shall extend through or shall wedge against the side of the shaft and shall be mechanically secured in place. The use of bolts, setscrews, knurled or fluted dowel pins, expansion pins, roll pins, tension pins, spring pins, or other devices instead of the solid, smooth sided, stainless steel or monel taper pins or dowel pins shall not be acceptable.

Municipality	Supplements
SC:	**630.5 BUTTERFLY VALVES:** *Add the following paragraph:* Butterfly valves will be allowed only for valves 16 inches and larger. All butterfly valves will be tested for proper adjustment. The valve operator shall be accessibly located within a standard manhole per COS Standard Detail No. 2305-1. The manhole cover shall be stamped "City of Scottsdale Water". *Delete paragraph* ***630.5 BUTTERFLY VALVES:*** *(B) 3 INCHES THROUGH 12 INCHES: in its entirety*

630.6 AIR RELEASE AND VACUUM VALVES:

Valve assemblies shall be furnished and installed where shown and as detailed on the drawings.

(A) Air release on water mains shall be controlled by the use of an air release valve assembly, or size and type as shown on the plans. Air release valves shall be of the flanged or screwed type as shown and shall be similar and equal to Apco, Crispin or Simplex.

(B) Vacuum and Air Relief when called for on the plans shall be controlled by a vacuum relief valve on the air release valve noted above and the valves shall be of the same manufacture or may be a combination air and vacuum valve assembly similar and equal to Apco, Crispin or Simplex.

630.7 CONSTRUCTION METHODS:

All valves, their supports, manholes, vaults, and valve boxes shall be installed in accordance with Section 610.

Valves 16 inches and larger, before being shipped from the factory, shall have the flanged ends completely covered with plywood. Plywood shall be left on the valve until just before installation in the line.

630.8 MEASUREMENT:

Measurement will be by the unit each of the various kinds and sizes of valves, manholes, vaults, or tapping sleeves and valves, including valve boxes and covers.

630.9 PAYMENT:

Payment will be made at the unit price bid each and shall be compensation in full for the complete installation in place including all labor, materials, equipment, and all incidentals necessary to complete the installation. The compensation will also include the cost of necessary pavement replacement in excess of the pay widths allowed in Section 336 for pavement replacement over pipe trenches.

WATER TAPS AND METER SERVICE CONNECTIONS

631.1 DESCRIPTION:

This specification covers work by Contractors installing water services in new subdivisions by Permit and in projects under Contract. All the materials used shall comply with applicable standard specifications and the work performed in accordance with these specifications and standard details. The service connections shall be complete and all material shall be furnished by the Contractor except for the water meter.

All water service connections shall be constructed of Type K copper tubing or ultra high molecular weight polyethylene pipe of nominal iron pipe outside diameter.

All new subdivision water lines shall be staked for line and grade at 100 foot intervals by the Developer's Engineer prior to construction. All meter locations shall be staked by setting two stakes for line and marking one of the stakes for grade.

Municipality	Supplements
ME:	Z. Subsection 631.1 – Delete all references to "polyethylene pipe" from these subsections.

631.2 MATERIALS:

Copper pipe, tubing and fittings shall conform with Section 754. Polyethylene pipe shall conform with Section 755.

All fittings, pipe and tubing for polyethylene and copper pipe shall be as noted on standard details.

Municipality	Supplements
SC:	**631.2 MATERIALS:** *Add the following paragraph:* Pack joint meter stops or corp stops shall be used exclusively. Polyethylene and polybutylene material shall not be used in any water system installation

631.3 INSTALLATIONS:

631.3.1 General: Installation of copper tubing for meter service connections shall be in accordance with Section 754.

Meter service connection with copper tubing shall be in accordance with standard details.

The water service connection shall include the tap on the main, the corporation stop, the saddle if applicable, service pipe, appurtenant fittings, the curb stop, meter box and meter box cover, in accordance with standard details. Water meter boxes shall be installed in accordance with standard details to line and grade set by the Developer's Engineer. Upon acceptance, the Developer shall be responsible for damage to water meter boxes and covers until such time as the meters are installed by the Contracting Agency.

After the installation and acceptance of the water main and meter service pipe connections the water meter will be installed by the Contracting Agency upon proper application and payment of prevailing fees.

Municipality	Supplements
SC:	**631.3.1 General:** *Add the following paragraphs:* Water taps and meter service connections shall be installed in accordance with COS Standard Detail No. 2330. All taps made to existing water lines shall be done by authorized City personnel, or by a Contractor authorized by the City. Water meters shall not be constructed in driveways sidewalks, washes or retention/detention areas unless approved by the City.

	All water service lines constructed under existing pavement shall be installed by mechanical/pneumatic underground boring unless otherwise approved by the COS Transportation Maintenance Director. Water boring is not allowed for construction of water service lines under existing pavement.

631.3.2 Standards: Except as otherwise specified all work shall be done in accordance with Sections 601 and 610.

631.3.3 Excavation and Backfill: The backfilling and compaction may be done as soon as the service line is installed, except backfilling and compaction shall not be completed around the corporation stop at the main water line until after inspection and recording of all tap locations. Trench bottom must be smooth and free of sharp objects. The minimum width of trench for water service pipe shall be 3 inches. The minimum depth of service pipe shall be 30 inches below the finished paving grade.

631.3.4 Polyethylene Pipe: Polyethylene pipe shall not be kinked, gouged or damaged during installation and backfilling operations. The pipe shall be placed in the trench allowing at least 12 inches per 100 feet for thermal contraction and expansion. Polyethylene pipe has a high thermal expansion and should never be confined under tension. The pipe should not be stored in the sun or left in the trench under abnormal high temperature. The pipe shall be carefully snaked in the trench bottom and covered up with uniform slack throughout its length. In trenches less than 8 inches in width, the expansion shall be obtained by making the tap on the opposite side of the main from the water meter and providing a loop of slack service pipe back over the top of the water main. Before installing, inspect pipe to detect any damage that may be caused by shipping, storage or handling. Damage spots can be cut out and pipe recoupled with Ford C-66-33, C-66-44, or approved equal brass compression fitting to form a continuous length. Damaged pipe shall not be used. Polyethylene pipe shall be cut only with a tubing cutter with rollers properly designated for the size of pipe being cut. When polyethylene pipe is used, the meter box setting must be placed parallel to the back of the sidewalk in accordance with standard details. Polyethylene pipe shall be installed with large sweeping bends with radius of not less than 18 inches. Polyethylene pipe has a cold flow characteristic and must not be installed under a stressed condition. Compression fittings only may be used with the plastic being held securely between metal to metal. Stainless steel or brass inserts shall be placed in the proper position in each compression fitting with care taken to assure that the insert remains in place when the fitting is tightened. All meter service lines shall extend at right angles from the main to the curb lines.

631.3.5 Service Taps: One inch and 3/4 inch service taps to new meter mains may be made with a saddle, tapped coupling or direct tap in accordance with the following provisions:

The Developer may use heavy tapped couplings for meter service connections on all sizes of pipe including the 3 inch pipe in cul-de-sac streets. Bronze corporation stops must be installed in the tapped couplings prior to pressure testing or disinfection of the water main. Normally in subdivisions no saddles are required for 6 inch pipe and larger. At the Contractor's option, saddles may be used on all 6 inch pipe and larger. All service connections on major and collector streets shall be made with saddles or heavy duty tapped couplings regardless of the water main size or service pipe size. All taps on pipe smaller than 6 inches must be made by either a saddle or heavy tapped coupling with bronze insert. Direct taps must be made by the use of a corporation stop with tapered AWWA machine thread. All wet taps must be made by the Mueller Type B-100 tapping machine or approved equal. A sharp tapping bit must be used in order to obtain clean sharp threads. In general, each tapping tool should be resharpened or discarded after making 6 taps. All copper service pipe which is attached to metallic water mains shall be insulated at the corporation stop with a dielectric insulator. The minimum distance between taps, saddles, and tapped couplings shall be 3 feet.

Municipality	**Supplements**
TE:	SECTION 631.3.5 Double strap bronze saddles are required on all sizes of ACP pipe for water service sizes through 2".

631.4 TESTING:

All services, service taps and fittings shall be tested along with the water main in accordance with Subsection 610.14.

631.5 CLEANUP AND COMPLETION:

Upon completion and acceptance of all phases of the water main and meter service lines the Developer shall release the new subdivision water system to the Contracting Agency for final operation and maintenance with all interior valves and corporation stops in open position and with all meter curb stops and valves at the connections to existing mains closed.

631.6 INSPECTION:

The Developer's Engineer shall make an as-built plan and make a record of the locations of all water service connections prior to the connections being covered up. This as-built plan shall give the stationing of each service tap. The stationing to be continuous for each street, and shall begin at the street intersection or property line at the end of the block.

Municipality	Supplements
SC:	**631.6 INSPECTION:** *Add the following paragraph:* The location of newly constructed water service lines shall be marked with a 2-inch x 4-inch x 30-inch long wooden stake. The stake shall be driven firmly into the ground exposing a minimum of 12 inches of the stake. The stake shall be labeled to indicate "water service".

631.7 SERVICE OVER 2 INCHES:

All service taps larger than 2 inches shall be made by the Agency after an application and payment of prevailing fees, unless otherwise required by the Agency.

Municipality	Supplements
TE:	SECTION 631.7 All taps may be made by contractors or City Forces upon proper application and payment of prevailing fees and upon approval and inspection by the City

631.8 SERVICE ON EXISTING MAINS:

Where all or part of a new subdivision is served by existing water mains, only authorized personnel of the Contracting Agency shall install the service connections upon proper application and payment of prevailing fees.

CH:	**APPENDIX A** Procedure P-222 1. Permits are required for any work within the public right-of-way, including public utility easements. 2. Distribution mains for irrigation, reclaimed water, and water. Distribution mains (generally four inches [4"] or greater in diameter) which serve large areas and/or multiple parcels will require the following: A. An agreement with the City. B. The granting of an easement by the City for the purpose of installing the irrigation main where the owner of the main has prior ownership rights. (This requires Council approval.) C. Approval of plans by the City Engineer. D. In the case of reclaimed water lines, compliance with City of Chandler Standard Specification No. 9. 3. Service lines for irrigation, reclaimed water, and water. Service lines to individual parcels or properties (generally those less than a four inch [4"] diameter) will not require plan approval but must meet the following requirements:

	A. Lines may be installed in rights-of-way or public utility easements outside of paved areas. B. Street crossings shall be sleeved and shall be a minimum of Type "K" Hard Copper per MAG Spec. No. 754, or other material approved by the City Engineer. C. In cases where service is required to all lots or other situations which would require crossings at other intersections, mains will be required on both sides of the street. D. Irrigation lines shall be constructed at least two feet (2') below finished grade. E. For reclaimed water lines, a minimum separation of six feet (6') from potable water mains and service lines must be maintained and Maricopa Association of Governments (MAG) Standard Specification and Detail requirements for sewer and water separation or encasement shall apply to all crossings of potable lines. F. Valves located on reclaimed water lines shall be in accordance with City of Chandler Standard Specification No. 9. 4. The City Engineer will determine the classification of irrigation lines as distribution mains or service lines.

Municipality	**Supplements**
TE:	**SECTION 631.8** Contracting may install all sizes of water services on existing and new mains upon proper application and payment of prevailing fees and upon approval in inspection by the City.

Maricopa County has added the following:

Municipality	Supplements
MC:	**635.1 Description:** Work under this Section consists of constructing cast-in-place Concrete Lined Ditch (CLD) in conformance with the details shown on the project plans, the applicable provisions of Section 505, and these Specifications.

Municipality	Supplements
MC:	**635.2 Materials:** Concrete shall be air-entrained Class B Portland cement concrete conforming to the requirements of Section 725. All other materials incorporated in the CLD installation shall conform to the project plans, to the project Special Provisions, to the MAG Standard Details, and/or to appropriate Part 700 materials specifications.

Municipality	Supplements
MC:	**635.3 Construction:** Subgrade for the concrete ditch shall be shaped to conform to the elevations and dimensions shown on the project plans. The subgrade shall be compacted in accordance with the requirements of Section 301.3 (C), except that the depth of compaction shall be 12 inches below the flow line of the completed ditch. The CLD shall be slip-formed, or cast as approved by the Engineer. The finished surface of the concrete shall be free from rock pockets and surface voids, and shall be comparable to the finish obtained by the use of a long-handled steel trowel, as approved by the Engineer. Transverse grooves 1/8 inch in width and 5/8 inch in depth shall be made in the placed concrete lining at intervals of 10 feet, and maintained to the required dimensions until the concrete has set. The placed concrete shall be cured by the use of a white pigmented membrane-forming compound (AASHTO M-148 Type 2) conforming to the requirements of Section 726.

Municipality	Supplements
MC:	**635.4 Measurement:** Measurement for this work will be by the linear foot of Concrete Lined Ditch.

Municipality	Supplements
MC:	**635.5 Payment:** Payment for this work shall be made at the contract unit price bid for Concrete Lined Ditch. Such payment will be full compensation for the item, complete in place, including all necessary materials, excavation, subgrade preparation, concrete, labor, and equipment.